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WHY SILVER CEASES TO BE MONEY.

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THE striking fall in the price of silver and the unmistakable tendency among civilized countries to cease using it as a basis for currency, suggest the inquiry whether these results are accidental or flow from causes so regular and continuous in their application as to be analogous to physical law. Thirty years ago most economists would have hesitated little in seeking analogies of this sort. The general conclusions on which economists were then agreed were often stated to be natural laws, as certain and immutable in their application as the laws of the physical universe. The general rate of wages was governed by natural laws; prices were determined by natural laws, which combinations and speculators could not violate with impunity; monetary phenomena were subject to similar unalterable conditions. The value of the precious metals, like that of other commodities, was determined only by their cost of production, and legislative action seeking to regulate their value and bring about their concurrent circulation must of necessity be futile.

Of late the language even of conservative economists has been more guarded. The more ardent representatives of the new movement in economic thought go further, and reject once for all the notion of natural law in economic phenomena. Even those who appeal with confidence to economic laws must admit that their operation is in many ways unlike that of physical law. They are stated to be tendencies; they are conclusions hypothetically true, or true only in the long run. Above all, the play of human volition, and of legislation as reflecting

human volition, is admitted to be not the least of the forces that affect economic phenomena. Wages and prices may be affected by combinations on the one hand, and by legislation on the other hand; doubtless within limits, but within limits not so narrow nor so easily defined as was formerly thought. So the value of money is subject to legislation in no small degree. Paper money, though of the purest *fiat* character, with no hope or promise of redemption in specie, may yet perform with reasonable efficiency the functions of a circulating medium. No doubt the degree of effect is limited, and the expediency of particular forms of legislative action is more than doubtful. But the possibility of effect can not be denied. In granting so much, we may give aid and comfort to those whose proposals on the currency are mischievous; but truth, fairly faced, compels the admission that the value of money is not fixed by natural law in the sense that it may not be seriously affected by legislation. Looking to specie alone, it is clear that convention and legislation are at least the immediate cause of their high value. If gold ceased to be used as money, and if all the gold in the world were to be used in the arts only, it is beyond question that its value would fall, and would remain low for an indefinite time to come; while a great and sudden extension in the use of gold for monetary purposes, such as legislation might conceivably bring about, would quickly raise its value.

Coming now more closely to the subject in hand, and the question whether silver is likely to continue in use side by side with gold, we encounter the suggestion that silver is doomed from the operation of great and permanent causes operating with the force of natural law. Silver at best is bulky in proportion to its value. For transactions on a large scale it is inconvenient; and as it gets cheaper, a given value becomes bulkier, and the metal less available for the great transactions of modern commerce. Iron, copper, and other metals have been used in their day for monetary purposes, and with the progress of civilization have given way to the "precious" metals. As the further advance in wealth and progress brings the need of a medium of exchange by means of which large transactions can be conveniently carried on, must silver meet with a similar fate, and gold become the only standard monetary metal?

No doubt it is true that as coin, and for circulation in the form of coin, obstacles of this sort are serious for silver. As copper can be used only for very small payments, so silver can be used only for moderate payments. A striking illustration of the impossibility of using silver directly on a large scale is furnished by the experience of the United States under the silver act of 1878. That act provided for the monthly coinage and issue of a very large

number of silver dollars—on the average, two and a half millions a month—and the expectation of the legislature was, at the beginning, that these bulky coins would find their way into circulation and use. In fact, but a very small proportion of them ever came into actual use. Notwithstanding every effort of the Treasury to get the coins into circulation, the community stubbornly refused to make use of more than a small proportion of them. Some sixty millions were got into circulation; but the remainder of the four hundred millions which were coined lie unused in the vaults of the Treasury, and when issued by it flow back with a regularity and persistence not unlike the operation of natural law.

But the experience of the United States under this same act of 1878 suggests a very easy mode of surmounting this difficulty and of securing the actual and effective use of silver in indefinite quantity. The printing press and the engraver's art have revolutionized the situation. The silver certificates, which now form the largest single constituent in our every-day money, were issued, at first sparingly, later more generously, to represent the coined dollars and to circulate in their place. They are printed in any desired denomination; they are easy to carry; they circulate more freely even than gold coin. It is curious that this simple device should not have been thought of at the outset, and should have been evolved only after an experience, running through several years, of the impossibility of securing the circulation of the actual coins. But the lesson has been learned, and in the schemes for the free and unlimited coinage of silver dollars it is now always proposed that the silver shall indeed be freely coined, but that its actual circulation shall take place through certificates representing the deposit of the coined metal in the Government's hands. By a machinery of this sort any durable commodity may indeed become the basis of the monetary circulation, and the crucial question becomes not one of the possibility of the use of a commodity, but one of its expediency.

This leads us to another phase of the question, the inquiry whether silver possesses that stability in value which is admitted on all hands to be essential for money. If the price of silver, like that of copper and iron, is subject to great and rapid variations from changes in the conditions of production, it is inexpedient, even though possible, to make it the basis of the circulating medium. If the great decline in the price of silver in the last twenty years is due to causes like those which have brought down the price of copper and the price of iron, we have strong ground for refusing to use it further, except for subsidiary purposes like those for which copper continues to be used. But here it may be answered, and certainly with much show of reason, that the decline in the price of silver has been due largely to legislation. The civ-

ilized countries one after another have given up the use of silver, and by so narrowing the field for its use have caused a fall in price to take place which otherwise would have been averted. Germany gave up the use of silver, except for subsidiary purposes, in 1873. The United States dropped silver from her list of coins in the same year. France and the Latin Union virtually closed their mints to the free coinage of silver in 1874. Italy and Austria, in resuming specie payments—the one in 1883, the other in 1893—refused to adopt any but a gold standard. If in all these countries silver had been freely coined; if in Germany, France, the United States, and Austria, silver had retained the footing before the law which it had twenty-five years ago, the price undoubtedly would not have fallen so much, and the objection to its use from the fall in its price would certainly be much less strong than it is. Unquestionably, the great increase in the production of silver has contributed to bring down its price; but it is at least probable that the fall would have been less, and indeed that there would have been little fall, if any, in the gold price of silver if the mints of all those countries had remained open to silver as they were in 1870. Whether such a state of things would have been conducive to the general prosperity of these countries is another question. Looking merely at the point now under consideration—the cause and meaning of the lower price of silver—we must admit that legislation has been an important cause among those that brought it about.

We may go further with this line of thought, and consider how far it is possible that legislation might affect the price of silver in the future. If at the present time an effective international agreement were adopted for the wide use of silver as money in civilized countries, the price of silver undoubtedly would be raised for some considerable time. An agreement of the great countries, such as England, France, Germany, and the United States, for the free coinage of silver at a fixed ratio with gold would undoubtedly absorb much silver, would clear the market of heavy stocks, and would raise the price of silver in terms of gold to the point fixed by the international ratio. Such an agreement could hardly fail to bring about the concurrent circulation of silver and gold in the contracting countries, and to establish a real and effective bimetallism. How long this concurrent legislation would continue, and how long, even if the legislation continued, silver and gold would remain equal in relative value at the agreed ratio, are different questions. The future production of silver, the possible extended use of gold for other than monetary purposes, the probable increased use of gold in countries outside the international agreement, would very likely cause gold to disappear in the end from the contracting countries, and so would make silver the sole basis of their circulating

medium. But this result would not be brought about for a long time, measured by generations rather than by years. Certainly for a series of years international bimetallism, if adopted, would at least be not ineffective. No doubt all this is idle speculation, so far as any political probabilities are concerned. International jealousy, and a sufficient satisfaction in most countries with the existing state of things, make such an agreement impracticable. But this does not answer the question of principle, or show that the wider use of silver is restricted by any natural law. Doubts as to the expediency of the change and unwillingness to enter on hazardous legislation are the serious sources of difficulty for those who demand a free use of silver for currency.

The real question for the future of silver, then, is one of the expediency and possibility of legislation. It may be freely admitted that if legislation were different, the silver situation would be essentially different. And ultimately legislation will doubtless respond to the pressure of expediency. If it should appear that the exclusive use of gold works ill, that the failure to use silver causes mischief, and that the wider use of silver would make things better, we may expect that eventually the civilized countries, either by international agreement or by separate legislation, will retrace their steps and endeavor to secure the use of both metals. The fundamental question of expediency, again, is one as to the stability of prices and incomes. If under the gold standard there is a steady tendency toward lower prices and lower money incomes, and if such a decline works evil, there is ground for demanding a change. If, on the whole, the disuse of silver is accompanied by no mischievous changes, things may remain, and in all probability will remain, as they are.

So far as the experience of the past is concerned, it is not to be questioned that in fact there has been a general decline in prices since the date, roughly speaking, when silver began to be discarded and gold became the sole basis of the medium of exchange. The year 1873 brings at once the high-water mark of general prices and the beginning of the demonetization of silver. During the last twenty years wholesale prices and retail prices have steadily pressed downward. So far there is a *prima-facie* case for the proposition that it is gold that has appreciated rather than silver that has depreciated. But another equally striking and unquestionable phenomenon of the last twenty years has been that the money incomes of all classes of society have not gone down, but have rather tended upward. Such a movement, combined with the movement for lower prices, simply means that material prosperity has increased on all hands, that our income in terms of commodities is growing, and that men are getting more in return for their labor. Moreover, it is not to be

denied that on the whole and in the long run general prosperity has been great and wide during the last generation. The usual cycles of speculative activity and industrial depression have appeared, and at the successive periods of surface depression the cry has been raised that some unusual cause, like the demonetization of silver, was leading to general calamity. But the upward turn of the wave soon reappeared, and the growth of material prosperity, good years and bad years taken together, has not been interrupted.

Looking, too, at the relations of debtors and creditors, we find on the whole little to complain of. No doubt a period of simple rise or fall in general prices operates unjustly. When prices and money incomes rise, creditors do not get their dues; when they fall, debtors are subjected to a painful burden. But where we have the phenomenon of money wages and money incomes which are steady and on the whole probably increasing—and this is what the world has seen during the last generation—the situation approaches as near justice as is possible in things human. A debtor who borrowed five, ten, or twenty years ago has an undiminished money income, and can not be said to feel special hardship when he repays his debt, even though the prices of commodities may have decreased. That individual debtors and classes of debtors may have suffered is beyond question; but in the mass the situation has not given rise to general hardship.

Hitherto, therefore, the adoption of the gold standard, the drift toward restricting silver to use as a *quasi*-subsidiary coin, have not worked ill. Indeed, it may be said to have prevented ill, since the use of silver side by side with gold, in view of the enormous increase of the production of silver, in all probability would have disturbed seriously the stability of the monetary medium. What, now, of the future? Are the same tendencies likely to appear in years to come, and is the gold standard likely to work well in the future as it has in the past?

In answering these questions we must not refuse to face certain facts in the situation insisted upon by the bimetallists. The supply of gold available for monetary use is not likely to increase rapidly in the future. The production of gold has been nearly stationary for the past twenty years. In the last two or three years an upward movement has appeared; it remains to be seen, however, whether any permanent advance will be maintained. The use of gold in the arts is apparently increasing, and is likely to continue to increase; and it absorbs a growing part of the annual supply. Meanwhile the wealth and population of civilized countries are advancing rapidly. If stability in money affairs is to be secured, some steady increase in their circulating medium must be provided for. If we regard gold coin alone, and

consider the development of the currency to be limited to the coin or to be in exact proportion to the coin, the situation may be fairly described as ominous. There would be ground for saying, as men of science have recently done,* that eventually the gold standard will become untenable, and that silver will force its way into use side by side with gold, if not to the exclusion of gold.

But the situation is modified, if not transformed, by another factor in present and in future industrial history: that development of credit machinery which forms the most striking phenomenon in the monetary history of modern times. In the development of credit as a substitute for money we have something like a natural law, which will put to naught the predictions of those who predict disaster from the failure to make wider use of silver. If, indeed, coin money were the sole or the most important constituent in the medium of exchange in civilized communities, silver or some other metal must certainly be brought in to supplement the scanty growth of the supply of the gold. In fact, however, the actual currency of civilized countries tends to consist less and less of specie, more and more of credit substitutes for specie. Bank notes, government notes, and above all bank checks, actually perform the commercial transactions of civilized countries. Specie is the basis of exchange; it is the measure in terms of which the value of commodities is expressed; but it is only to an insignificant extent the medium by which exchanges are actually conducted. The use of credit is of course most highly developed in countries like the United States and England, which lead the world in general industrial development. It is growing steadily and surely in continental Europe, and, beyond question, will continue to grow. Each individual, each financial institution, each government, is tempted to enlarge the scope of credit operations and to diminish the use of actual coin; and the steady pressure of these motives makes the tendency as sure and unalterable as physical law.

That this tendency brings its dangers can not be denied. An ever-increasing volume of credit is based upon a relatively smaller foundation of specie, and the evils of a sudden impairment of credit become more and more serious. It has been attempted to obviate the dangers by enlarging the basis of specie; and the wider use of silver is advocated as one method of broadening the substructure. But efforts in this direction are likely to have but temporary results. A broader basis of specie is likely, under the influence of the same forces which now lead to an extended use of credit, to bring about in due time an expansion of credit machin-

* See Die Zukunft des Silbers, by Eduard Suess, Vienna, 1892.

ery in some way proportionate to the enlarged foundation on which it rests. After a brief respite the difficulties which it was proposed thus to obviate will reappear with undiminished intensity. The surer method, and that which is developing under the stress of need and the growth of experience, is to strengthen the foundation rather than to enlarge it. The specie which serves as the basis of the swelling volume of credit transactions is massed in fewer hands, and so is made more effective in sustaining the superstructure. The great public banks of European countries are guardians of the treasure which gives tone to their currency and serves as the standard for transactions in which it is used to less and less extent in bodily shape. The central stock which serves the same purpose in the United States is held, not by a semi-public institution to whom the duty has been delegated, but by the Federal Treasury directly. Its amount has been seriously lessened of late, and may be subject to further drain in the immediate future. But there are no indications that the supply of gold obtainable for this purpose is inadequate, in the United States or in the world at large, to serve the uses likely to be made of it in the future. Our own reserve should be enlarged; and there can be little doubt that the community, once aroused to the situation, will not permit it to shrink to the point of real danger.

So far as the visible future is concerned, we may therefore look to the maintenance of the gold standard by all the great civilized countries. Silver will be used for subsidiary purposes to some extent in all advanced countries, and apparently to a very large extent in the United States. But silver will not again become standard money, freely coined for all holders. It will have to seek its market, partly for use in the arts, partly for subsidiary purposes as money in the countries of advanced civilization, partly for more or less complete monetary use in regions like India, China, and South America. Within the last two months the British Government in India has taken a step of far-reaching consequence, in suspending the free coinage of silver in that country. The step is not definitive, and it remains to be seen what policy will finally be adopted. Whatever may be done, a considerable flow of silver to India is likely to continue in the future; the market for the metal there has by no means been wiped out. But the conditions under which silver can be disposed of must be seriously affected by the cessation of unlimited coinage in the country in which alone very large quantities found their way into permanent monetary use through a free mint. The new move, moreover, whatever its effect may be on the quantity of silver which will actually find its way to India, must in any case have an important effect on the future of silver in its political aspects. It wipes out the possibility of free coinage of silver in

the United States; it makes highly probable the diminution or cessation of large silver purchases by the United States. The grounds of expediency against making silver the standard of value, or so legislating that it may possibly become the standard of value, have become stronger than ever.

What the price of silver will be in the future must depend on the volume of the annual production as compared with the occasion for its employment in the several ways just mentioned. The crucial question is that of production. During the last twenty years the world's production of silver has more than doubled. Geologists tell us that this great increase has been due to an extraordinary succession of lucky finds, not likely to be repeated; and they predicted, even before the collapse in the price due to the action of British India, that silver would be produced in smaller quantity in the future. Predictions on this subject, even from the most competent men of science, are to be accepted with caution, and it remains to be seen what the future will bring. Those old mines or newly discovered bonanzas which can produce silver at very low cost will continue to turn it out, even though a mixed feeling of panic and bluster may have caused them for the moment to stop operations. Mines which have been working at a moderate profit or none at all will one by one cease, now that the prospect of a rise or even maintenance of the price of silver has become so desperate. The gambling character of the business makes it difficult to use the reasoning which would apply to most industrial operations; but apparently we may look for some diminution of production. If this occurs, silver may maintain something like its present value, and the commercial relations between gold-using and silver-using parts of the world will gradually adapt themselves to the new basis. If production continues at anything like its present rate, still more if it augments, no one can tell what may happen to silver. Its price may fall indefinitely, and in the end it may disappear from monetary use as completely as copper has done. But a diminution of production and of the quantity of silver finding its way to the market seems the more probable outcome; and with this a price at a permanently lower level than ever in the history of the world until within the last twenty years. In either case silver ceases to be the basis on which the countries of advanced civilization rest their monetary systems: not so much from its physical unfitness, as from the increasing use of a more refined and highly developed medium of exchange, needing for its foundation a moderate supply of specie having a stable and uniform value.

FOLK-LORE STUDY IN AMERICA.

By LEE J. VANCE.

IN the summer of 1887 a circular letter containing a proposal for the formation of a Folk-lore Society in America was quietly, perhaps timidly, sent to a faithful few. Again, in October of the same year was issued a second letter, subscribed with a hundred and four names, representing different parts of the United States and Canada. Briefly stated, it was proposed to form a society for the study of folk lore, of which the principal object shall be to establish a journal of a scientific character designed—

1. For the collection of the fast-vanishing remains of folk lore in America—namely, (*a*) relics of old English folk lore (ballads, tales, superstitions, etc.); (*b*) lore of negroes in the Southern States; (*c*) lore of the Indian tribes in North America (myths, tales, etc.); (*d*) lore of French Canada, Mexico, etc.

2. For the study of the general subject and publication of the results of special students in this department.

The outcome was that, on the 4th of January, 1888, a goodly number of persons interested in folk-lore study assembled in University Hall, Harvard University. Then and there The American Folk-lore Society was born and baptized. Prof. Francis J. Child was chosen president, an honor merited by his long and splendid service in the field. Fourteen persons were named as a council to conduct the affairs of the new society. Mr. William Wells Newell was elected secretary. At the same time a committee, consisting of Prof. T. Frederick Crane, Dr. Franz Boas, Rev. J. Owen Dorsey, and the secretary, was appointed to make arrangements for the publication of a journal.

The first number of the Journal of American Folk Lore made its appearance in April, 1888. The five volumes already issued are ample evidences of the wealth of popular traditions in this country. They form a perfect mine of information for the study of folk lore. The contributions which have been printed in the Journal touch on almost every side of the subject. They include myths and tales of the Indians, negroes, and creoles, strange and curious customs, superstitions of all kinds and all shades, beliefs in witches and goblins, queer practices, magic and divination, songs, dances, games, nursery rhymes, riddles, wise saws, and dialect words.

Few persons, even those who were directly interested in the study, had any adequate idea of the body and bulk of folk-lore materials extant in North America. First in quantity and quality come the collections of the lore of the Indian tribes. This, of course, was to be expected. The contributions by Prof. Hale, Dr. Boas, Mr. Beauchamp, Rev. J. Owen Dorsey, Mr. Chamberlain, Dr.

Mathews, Captain Bourke, Dr. Fewkes, Mr. Mooney, Dr. Brinton, Miss Fletcher, and others have been noticed by Prof. Frederick Starr in his article on Anthropological Study in America.*

Perhaps the most striking results have been obtained in fields heretofore unvisited and unworked. We refer particularly to the lore found within the past four or five years among foreign-born and English-speaking peoples, both in thickly settled districts and in out-of-the-way places. Dr. Hoffman's collection of the folk lore of the Pennsylvania Germans; Prof. Fortier's account of creole customs and superstitions, together with his versions of creole nursery tales; Mr. Mooney's and Miss Hoke's articles on the folk lore of the North Carolina mountain region; Mr. Culin's paper on Chinese customs and superstitions in Philadelphia and New York; Mr. Henry Lang's account of the Portuguese element in New England; Mrs. Bergen's and Mr. Newell's studies of current superstitions in different sections of the United States—these contributions, to name no others, show that emigrants to America, if they did not bring much material wealth, certainly carried with them what Carlyle calls "old clothes philosophy." Every number of the Folk-lore Journal has been a revelation to its many readers. We predict that greater surprises than those already given are in store for us.

PROF. FRANCIS J. CHILD.

The greatest progress in folk-lore study in this country has been made within the past six years, and it is significant to note that the Folk-lore Society has grown during the same time. Prior to 1887 the study of popular tradition in America was unorganized. Since then the investigations of special students in different fields have been collated and systematized, and, above all, those interested in the subject have been brought together. Thus to-day there is a certain *esprit de corps* among American folk-lorists that was unknown some six or eight years ago.

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* In The Popular Science Monthly for July, 1892.

Naturally the new society has had to do quite an amount of missionary work. What our folk-lore scholars are "driving at," the importance of the study of unwritten traditions, the value of Indian myths and rude customs, of negro fables, or of old superstitions, the great necessity of gathering the lore of American folk while there are time and opportunity—these are matters that the general public do not yet fully understand or appreciate. Folk lore is a study to which every one can add his or her mite, from the farmer to the stock broker, from the servant girl to the mistress. We find many quaint and curious items of superstition or traditionary lore in the parlor, in the kitchen, and in Wall Street. Indeed, we need only to read the daily newspaper reports of clairvoyants, mediums, fortune-telling, haunted houses, etc., to be reminded of those low forms of thought that characterize rude and uncivilized communities.

The American Folk-lore Society has continued to increase in numbers from the very beginning. It now has a membership of five hundred, which exceeds that of any similar organization in Europe. The influence of the society has been strengthened and extended principally by the formation of branch societies in different sections of the country. There are now folk-lore societies in six large cities—in Boston, Philadelphia, New Orleans, Montreal, Chicago, and New York. The Chicago Folk-lore Society is an independent body; the others are affiliated with the national society.

MR. W. W. NEWELL.

The effect of these local societies on the future study of folk lore in America can not be estimated at the present time. Already their influence has been felt in many quarters. The meetings bring people together for an interchange of views and for pleasant entertainment. Although these societies have a social side and function, they are in fact working societies, as the following will show:

The first local branch of the American Folk-lore Society was established in November, 1889, at Philadelphia—a city noted for

the number of persons interested in the study.* The stated meetings of the chapter are held on the second Wednesday of the month from November to June. Many carefully prepared papers have been read at the meetings, and some of them have been printed in the Journal. Among these we may mention Miss Alice C. Fletcher's able address on Child Life among the American Indians; Mrs. de Guerrero's paper on Games and Popular Superstitions of Nicaragua; and Mr. Stewart Culin's interesting remarks on Children's Street Games.

PROF. ALCÉE FORTIER.

The Folk-lore Museum established in connection with the Philadelphia chapter is unique. Many rare and valuable objects have been collected and are deposited in the Museum of the University of Pennsylvania. These objects serve to illustrate myth, religion, custom, and superstition the world over. The collection includes idols and ceremonial objects from China, Japan, India, Thibet, Egypt, Polynesia, Africa, North and South America. Prominent in this exhibit are amulets and charms of paper and wood and metal. Very interesting are those implements used for divination and fortune-telling and those manipulated in games. Thus, the evolution of the playing card is shown; so too the games of chess and backgammon are displayed in their various forms or types. Nor have the games and toys and dolls of children been overlooked. They are all there—even Noah's ark, with its beasts and birds, two and two. Such a museum is an "object lesson" in folk lore.†

Several informal meetings of persons living in Boston and its

* The following officers were chosen: President, Mr. Victor Guilloû; secretary, Mr. Stewart Culin; treasurer, Mr. J. Granville Leach; librarian, Mr. John W. Jordan, Jr.; committee, Messrs. Richard L. Ashurst and Francis C. Macaulay, and Mrs. Cornelius Stevenson.

† It may not be amiss to call attention to the exhibition of folk-lore objects at the Columbian Exposition in Chicago. It forms part of a section of the Department of Ethnology and Archæology of the Exposition. There will be also an anthropological library and a display of the current numbers of folk-lore journals throughout the world.

vicinity were held during 1888–'89. But it was not until March, 1890, that "The Boston Association" of the American Folk-lore Society was organized.* The meetings are held once a month, from November to June, in the rooms of the Boston Natural History Society or at private houses.

The activity of the Boston Association has been considerable. Some pleasant features have been introduced into the proceedings in order to give variety to the study in which the members are interested. In 1891 a performance was held, under the auspices of the association, at the Chinese theater. Last winter an entertainment was given under the name of "The Japanese Dance." The dances presented histories or the phenomena of Nature, displayed by gesture and motion; thus, *Harusame* (the Dew of Spring) showed the falling of dew on flowers; *Sedogahataki* (the Vegetable Garden), a humorous dance, illustrating the gathering of pumpkins and the tripping over the vines; *Goshorasuma* illustrated how a maiden received her first love-letter, and so on.

PROF. D. P. PENHALLOW.

The Louisiana Association of the American Folk-lore Society was organized in December, 1891, at New Orleans.† The number of members is fifty. The meetings of the association are held in the library of Tulane University and at private residences, and they have been exceedingly profitable and agreeable.

The members of the Louisiana Association have a grand chance to make their work known and felt. They are at home in one of

* The following officers were chosen: President, Mr. Frederick W. Putnam; vice-presidents, Miss Abby L. Alger, department of Algonkin folk lore; Clarence J. Blake, folk music; Prof. Francis J. Child, English folk lore; Dana Estes, literature and publication; Miss Mary Hemenway, Zuñi folk lore; Colonel Thomas W. Higginson, Southern folk lore; secretary, W. W. Newell; treasurer, Arthur G. Everett.

† The officers of the association are: President, Prof. Alcée Fortier; vice-president, Mrs. Mary A. Townsend; secretary and treasurer, Mr. William Beer; assistant secretary, Edward Forster; executive board, Mrs. Francis Blake, Mrs. M. E. Davis, Mrs. George Howe, and Colonel William Preston Johnston.

the most promising fields of folk-lore exploration in the United States. There has been a strange mingling of races in Louisiana. The result is that relics of the voodoo or obi rites, conjurings, magic, medical superstitions, fables, plantation songs, and religious notions of the negroes linger on side by side with the superstitions, ghost stories, omens, charms, nursery tales, and rhymes brought by the whites from Europe. The quaint dialects of these settlers offer an inviting field of study which should not be overlooked.

The Louisiana Association has given an impulse to folk-lore study in the State, and it has resulted in the collection of many stories and superstitions current among the creoles and negroes "before the war." The ladies have contributed many items of traditionary lore. Mrs. Preston Johnston, Mrs. Mason Cooke, Mrs. C. V. Jamison, and Mrs. M. E. Davis have written out stories told to them in childhood by their negro nurses. The folk lore of French Louisiana has been collected by Prof. Fortier during the past twenty years. Some of this valuable material has appeared in the Folk-lore Journal, and some of it, entitled Bits of Louisiana Folk Lore, was printed in the Transactions of the Modern Language Association for 1887. Thanks to American scholarship, not to American liberality, the complete work of Prof. Fortier will be issued shortly, as the second of a series of monographs of the American Folk-lore Society.*

Miss Alice C. Fletcher.

It is with pleasure that we record the establishment of a society for the study of folk lore in Canada. The formation of the Montreal branch was due largely to the diplomatic efforts of Prof. D. P. Penhallow and Mr. John Reade, who soon had the cordial sympathy and support of many Canadian students, among whom

* The American Folk-lore Society is about to begin a series of Memoirs. The first of these will consist of a collection of Folk Tales of Angola (Africa) by Mr. Heli Chatelain. The connection of West African folk lore with that of American negroes brings the material within the field covered by the society, and should excite much interest.

we may name Hon. H. Beaugrand (ex-Mayor of Montreal), Dr. Louis Fréchette (*lauréat* of the French Academy), Mr. W. J. White, Mr. Henry Carter, Dr. Robert Bell, F. G. S., Dr. Beers, Dr. Le May, Dr. Kingsford, F. R. S. Can., and Dr. S. E. Dawson, Queen's printer. Several informal meetings were held during the winter of 1892, and in April of that year a permanent organization was effected.* The membership roll shows a list of about sixty names. Many interesting papers have been read at the meetings, and the social element has been combined with serious study in a most delightful manner.

It is hardly necessary to call attention to the opportunities for the study of folk lore in Canada. This has been done by Mr. Reade in a very suggestive paper read before the Montreal society.† We need only refer to the mingling of races in Canada. The Indian tribes of the Northwest; the descendants of the pioneers of French Canada, of the loyalists, and of the Scotch, Irish, English, and Germans; the scattered settlements of Russians, Hungarians, Norsemen, Chinese, etc., in western Canada—these folk afford as rich field for inquiries of the folk-lorist as he or she would desire. Some curious items of superstition, or traditionary lore, found in the provinces, have been collected, but much remains in the mouths of the folk, the plain people in country towns and districts. Meanwhile a series of investigations relating to the Indian tribes of the Northwest are going on under the auspices of the British Association for the Advancement of Science, aided by the Canadian Government.

The New York branch of the American Folk-lore Society was organized in February of this year.‡ The membership at the first meeting was about forty; it is now double that number. The metropolis has become the stamping-ground for representatives of all the nations of the earth. There are old-fashioned people as well as Huns and Vandals in New York. The right person will find plenty of folk lore in the "quarters" of the Italians, Poles, Jews, Czechs, Hungarians, Chinese, etc. Within a radius of one hundred miles around the city there are settlements that would furnish the material eagerly wanted by the Folk-lore Society.

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* The officers of the Montreal branch of the American Folk-lore Society for 1893 are as follows: President, Prof. D. P. Penhallow, McGill University; vice-presidents, M. Louis Fréchette and Mr. John Reade; secretary, Mr. F. E. Came; treasurer, Mr. W. J. White; ladies' committee, Mrs. Robert Reid, Mrs. L. Fréchette, Mrs. H. B. Ames, Mrs. K. Boissevain, Miss Macdonnell, and Miss Van Horne.

† Published in the Dominion Illustrated Monthly for June, 1892.

‡ The officers of this branch are as follows: President, Dr. H. Carrington Bolton; first vice-president, Mr. George Bird Grinnell; second vice-president, Mr. Richard Watson Gilder; secretary, Mr. William B. Tuthill; treasurer, Mr. Sydney A. Smith; ladies' committee, Mrs. Henry Draper, Mrs. Harriet M. Converse, and Mrs. Mary J. Field.

The other day Dr. Bolton found an intelligent, skilled workman in the metropolis, who used the magic mirror (the Urim and Thummim of the ancient Jews) for the purposes of divination. The seer made use of the Urim to guide his daily life, and to consult with the spirits of many distinguished persons from whom he received communications. Dr. Bolton found also a fruitful field of inquiry in the counting-out rhymes of children.* Another member of the New York branch who has contributed to our slender stock of knowledge concerning the Pawnee and Blackfeet Indians is Mr. George Bird Grinnell. He is at home with these "prairie people," as they are called. He has lived, slept, camped, hunted, and "swapped stories" with them. His collection of Pawnee Hero Stories and Folk Tales showed what other travelers had missed. Mr. Grinnell is by adoption a member of the Blackfeet tribe, and his book of Blackfoot Lodge Tales tells the life of a Blackfoot brave from infancy to his departure at death to the Sandhills—the happy hunting ground of the tribe. Among other members of the New York branch we may mention the work of Mrs. Harriett Maxwell Converse, who is by adoption a member of the Seneca tribe, and Mr. De Cost Smith, who has written and sketched cleverly the ceremonies of the Onondagas.

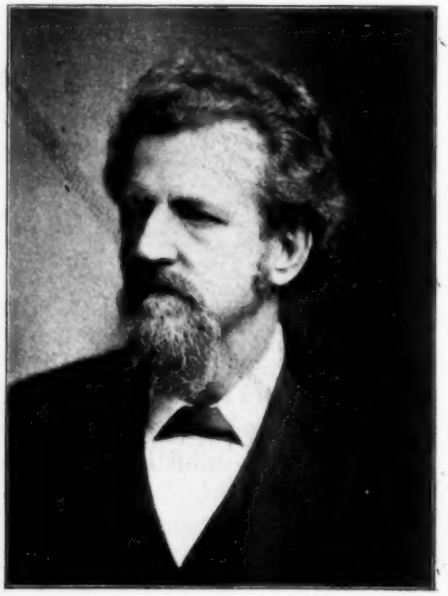
Mr. George B. Grinnell.

The Chicago Folk-lore Society is an independent organization, not a branch of the American Folk-lore Society. This society was organized in December, 1891.† The membership of the society numbers now about eighty persons, with about twenty

* The Counting-out Rhymes of Children: their Antiquity, Origin, and Distribution. A Study in Folk Lore. New York: D. Appleton & Co., 1888.

† The officers for the year 1893–'94 are as follows: President, Prof. William I. Knapp; vice-presidents, Captain E. L. Huggins, United States Navy, department of Sioux and cognate tribes; Rabbi E. G. Hirsch, Semitic folk lore; Prof. Frederick Starr, Dr. Washington Mathews, Indian tribes of the Southwest; Mr. George W. Cable, Southern folk songs; secretary, Lieutenant Fletcher S. Bassett, United States Navy; treasurer, Miss Elizabeth Head; directors, Mrs. Fletcher S. Bassett, Mrs. Potter Palmer, and Mrs. Edward E. Ayer.

non-resident members. A manual for the use of members has been prepared by Lieutenant F. S. Bassett, and it contains many practical observations and suggestions for collectors. The Chicago society publishes a quarterly journal called The Folk-lorist, edited by Lieutenant Bassett and Mrs. Bassett, both of whom deserve credit for promoting the organized study of folk lore in Chicago. The contribution on Illinois Folk Lore, by Miss Helen M. Wheeler, shows what the right person can do in the State outside of the cities. Many of the superstitions of the pioneers of the Western country have disappeared, but the traditional customs and beliefs of their descendants, if closely studied as they have been noted by some American novelists, should yield unexpected results.



COLONEL CHARLES C. JONES, JR.

The meetings of the Chicago Folk-lore Society are held once a month at the Woman's Club Rooms. They have been very interesting and well attended. Some idea of the useful work done may be gained from the programme presented at the meeting in April last. The guests of the evening were Mrs. French-Sheldon, the African explorer, and Captain John G. Bourke. There were contributions by Mrs. Molly Eliot Seawell, Miss Mary A. Owen (the author of a book of Voodoo Tales), Mrs. Eva Wigstrœm, of Sweden, Mr. A. M. Stephen, and Prof. H. Hurlburt. The readers were Major Joseph Kirkland, Mr. Franklin H. Head, Captain E. L. Huggins, and Mrs. Wilmarth.*

This completes the list of local folk-lore societies in America. It is expected that one or two new branches will be established before another year. There should be folk-lore societies in fields

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* The Chicago Folk-lore Society has adopted a seal and motto—an idea which might be used by the other societies. The figure in the seal represents the meal-sprinkler of the Navajos—the courier sent out by the priest during the ceremonies of the "Mountain Chant." The motto on the seal is the well-known line from Hiawatha—"Whence these legends and traditions." (Dr. Mathews's account of the ceremonies in Report of the Bureau of Ethnology for 1883–'84.)

in which opportunities to gather valuable material are found: for example, in the Pennsylvania coal fields, where Hungarians congregate; in the Southwest, where the negroes and "poor whites" touch elbows; in the Northwest, where the Scandinavians are numerous; and on the Pacific coast, where Indians, Chinese, and half-breeds mingle.

A few words as to the work of the officers and leaders of the national Folk-lore Society.* The honor of holding the presidency rightfully belongs to Prof. Horatio Hale, whose studies date back to a time when the term "folk lore" could not be found in Webster's Dictionary. His first important contribution was to the volume of Ethnography and Philology of the United States Exploring Expedition under Wilkes (Volume VII). Then Prof. Hale increased his reputation by editing The Iroquois Book of Rites.† This Iroquois book is almost pure folk lore, and has a special interest, as showing how authentic history can be derived from popular tradition where this has been handed down in public and solemn recitations. To this evidence alone we owe the establishment of the fact that Hiawatha was not a mythical hero, but an actual Onondaga chief, who lived between four and five centuries ago, and helped to form the great Iroquois Confederation. For further information on the story of Hiawatha, see Mr. Beauchamp's scholarly paper entitled Hi-a-wat-ha, in the Journal of American Folk Lore (for 1891, p. 295).

The man who is responsible for the very existence of such an organization as The American Folk-lore Society is William Wells Newell. He it was who issued the call to arms, who drafted the circular letter already referred to, who put the new organization in line with the great anthropological movement in America, who has generously given his time and services to the cause of folk lore; who, in short, has been the general executive officer of the society from the beginning. All this has been a labor of love with our honored permanent secretary. Mr. Newell won his reputation as a folk-lorist by his book of Games and Songs of American Children (1883). Since then he has contributed to the Journal of American Folk Lore a large number of valuable papers, which we all hope to see some day within the covers of a book.

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* The officers of the American Folk-Lore Society for the year 1893 are as follows: President, Horatio Hale, Clinton, Ontario; first vice-president, Alcée Fortier; second vice-president, D. P. Penhallow. Council, Franz Boas, H. Carrington Bolton, D. G. Brinton, A. F. Chamberlain, J. Owen Dorsey, Alice C. Fletcher, George Bird Grinnell, Otis T. Mason, and Frederick W. Putnam. Permanent secretary, William Wells Newell, Cambridge, Mass.; corresponding secretary, J. Walter Fewkes; treasurer, John H. Hinton, M. D.; curator, Stewart Culin.

† It forms No. 2 of Brinton's Library of Aboriginal American Literature, Philadelphia, 1883.

A clever writer in The Saturday Review (whom we suspect to be none other than Andrew Lang) begins his book review with two sentences which deserve to be quoted at this place.* He says: "(1) It is not very much to our national credit that an American, Prof. Child, is making far the best edition of our ballads. (2) Nor is it very much to the credit of Ireland that an American has made much the most interesting collections of her old popular tales." Prof. Child's monumental edition of English and Scottish Popular Ballads represents the best years of his life. It is a veritable mine of comparative folk lore, to which scholars will go again and again, and all will come away richer and wiser after their visit.

The American referred to in the second sentence above quoted is Mr. Jeremiah Curtin, a member of the Folk-lore Society. His collection of the Myths and Folk Lore of Ireland should make every lover of old Ireland his friend. Mr. Curtin gained his training and experience in collection of our Indian myths. He has published recently a collection of Myths and Folk Tales of the Russians, Western Slavs, and Magyars (1890), in which his singular ability as a collector and interpreter of popular tradition is again displayed. Another member of the Folk-lore Society, Mr. James Mooney, went over to Ireland with the purpose of studying the traditions of his ancestral county. His account of The Holiday Customs of Ireland is a remarkably fine bit of work.† Mr. Mooney's special work has been under the auspices of the Bureau of Ethnology. His examination of the theory and practice of medicine among the Cherokee Indians is a masterly presentation of an obscure and complicated folk practice.‡

The study of negro lore has been the means of making the reputation of at least one American writer. We refer of course to Mr. Joel Chandler Harris, to whom will always be given the credit of making the lore of the plantation interesting alike to the student and the general reader. His Uncle Remus Tales have a scientific worth, aside from a literary value. In his Negro Myths, Colonel Charles C. Jones has done for the dialect and folk lore of the negroes of the Georgia coast what Mr. Harris did so wonderfully well for the legends of the old plantation of middle Georgia. The stories of Daddy Jack and Daddy Sandy are on a par with the tales of Uncle Remus. But there is a difference in the lingo of the negroes; the darkies of the Georgia rice-fields and swamp region have almost a different language from that of the colored folk of Maryland or of Tennessee.

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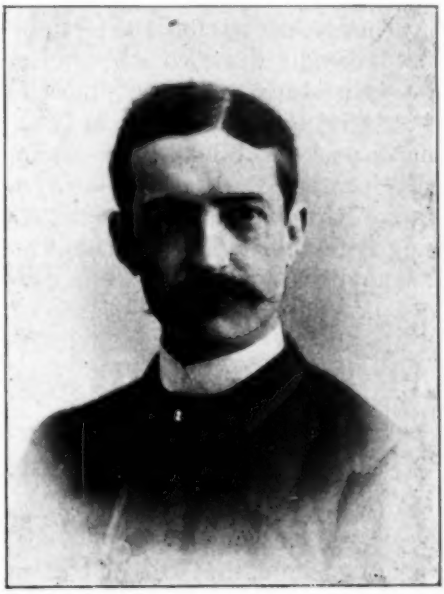
* For April 12, 1890.

† Published in the Proceedings of the American Philosophical Society, 1889.

‡ In the Journal of American Folk Lore, 1890; also Bureau of Ethnology, 1885–'86.

It did not take Prof. Crane long to make the interesting discovery that the fables and "yarns" of Uncle Remus were parallel to stories Prof. Hartt heard from his guide on the Amazon River, to stories collected by Dr. Bleek in South Africa, and to popular tales in Europe. He was able to trace the majority of the Legends of the Old Plantation to their foreign variants.* Prof. Crane is our acknowledged authority in the field of storiology. He first published a charming collection of Italian Popular Tales, with a scholarly introduction and elaborate notes. His able paper on Mediæval Sermons, Books, and Stories was followed by a critical edition of The Exempla, or Illustrative Stories from the Sermones Vulgares of Jacques de Vitry, published by the English Folk-lore Society in its series of memoirs (1890). Jacques de Vitry was an eloquent and popular bishop of the thirteenth century, who made great use of apologues, or *exempla*, in his sermons, with the express purpose of instructing and sometimes of amusing his audiences. These illustrative stories were diffused over all Europe, and some of them have won their way into literature—have reappeared now in the fables of La Fontaine, and then in the plays of Molière and Shakespeare. Prof. Crane has published recently an edition of Chansons Populaires de la France, a selection from French popular ballads.



PROF. T. FREDERICK CRANE.

Thus far the work of American folk-lorists has been directed almost entirely to the collection of material to be collated and examined afterward according to scientific methods. American students think that the time has not yet come for theoretical discussions, such as English and Continental scholars have waged so sharply at times and without good cause. Nor are they ready yet to favor the establishment of a separate science of folk lore. In the Handbook, issued by the authority of the English Society, it is stated that "the definition of the science of folk lore, as the so-

* Prof. Crane's study appeared in The Popular Science Monthly, April, 1881.

ciety will in future study it, may be taken to be as follows: the comparison and identification of the survivals of archaic beliefs, customs, and traditions in modern ages." So far, so good.

But the truth is that the exact definition of the term "folk lore" is still a matter in dispute. The proper place of the "science of folk lore" remains to be settled. Thus there will be two folk-lore congresses at the World's Columbian Exposition: one congress to be held in the month of July, in connection with the Department of Literature; the other Folk-lore Congress to be held in August, with the Congress of Anthropology. There is no department of comparative folk-lore in any college or university.

Finally, we attribute the rapid progress and popularity of folk-lore study in America and in Europe to three reasons: (1) Folk lore is a study to which almost every one can contribute something; (2) folk lore is a study which throws a flood of light on man's past mental evolution and culture-history, as the Germans call the study; (3) folk lore is a study in which the student of religions, the student of morals, the ethnologist, the antiquarian, the psychologist, the historian, the poet, and the *littérateur*, each finds a different interest and a different value.

REFORMATORY PRISONS AND LOMBROSO'S THEORIES.

By Miss HELEN ZIMMERN.

IN no branch of social science has so much progress been made of recent years as in the treatment of the criminal. Mankind in general has at last come to recognize what Sir Thomas Moore knew long ago, that the end of punishment is "nothing else but the destruction of vices and the saving of men." The prison has become, and rightly, a moral hospital. Whether, however, we are not now inclining to err a little too much on the other side in our latter methods of prison treatment is a question that is exercising the general public as well as criminal anthropologists and professors of legal medicine. Are we not perhaps encouraging rather than deterring crime by our present tendency to prison philanthropy? Do we not tend to make prison too pleasant a place, so that those who have been there are apt to sing in an irreverent spirit the words of the hymn that telleth—

> "I have been there, and fain would go;
> It is a little heaven below"?

Is it no longer good, as the gospel teaches, that the transgressor's way be made hard lest a worse evil befall?

On all these points there is unquestionably no greater authority in the world to consult than Prof. Cesare Lombroso, Professor

of Forensic Medicine at the University of Turin, who may be regarded as the inaugurator of the modern science of criminal anthropology, the thinker whose work on Criminal Man (L'Uomo Delinquente) had, on its appearance in 1889, an influence as decisive as had in its day the publication of Darwin's Origin of Species. In the vexed question that is now waging as to the treatment of criminals, in which we find ranged on one side men like W. Z. Brockway, of the Elmira Reformatory, and on the other an authority such as Mr. William Tallack, of the Howard Association, a society that bears the name of the great English prison philanthropist and exists for the purpose of alleviating the malefactor's pain, it is well to go to the fountain head and hear what Lombroso has to say on the point.

Now, Lombroso starts from the premise that a reason must exist why certain men are impelled by their very nature to commit crimes, and that hence there must be a difference in their very organism sufficiently marked to distinguish normal men from those morally or mentally mad. In the various medical clinics numerous and minute psychiatric observations, calculations of the most insignificant abnormities in the eurythmia of the human body, confrontation and establishment of mathematical data, have all combined to advance the science of criminal anthropology, so that it has become possible to divide mankind into three great principal classes—normal men, criminal men, and madmen. Now, Prof. Lombroso, from his own experience and that of the scholars who work under his direction—many of whom, like Prof. Enrico Ferri, have become almost as prominent as himself—had come some while ago to the conclusion that an absolute reform is required in the old methods of criminal punishment, and the first thing to do was to distinguish with great care the congenital criminal from the madman. The professor condemns rigorously the carelessness with which the legal tribunals pronounce sentences, and points out with much acumen that inconvenience, not to say irreparable harm, is thus done, mischief that always accrues to the detriment of those who perform their duty, and who surely have a right to be protected by the state. Hence, says Lombroso, it is above all others the magistrate who should pursue the study of criminal anthropology, because while every one of those who have had contact with malefactors, such as the members of their own family and prison directors, regard them as men different from others—that is, persons of weak mind or almost insane, and never, or at least hardly ever, susceptible of improvement; while the psychiatrist finds it impossible in most cases to distinguish clearly between madness and guilt, the legislator, on his part, rarely gives heed to the acute criticisms of the alienist, to the timid objections of the prison officials. As a rule,

magistrates hold that the cases are rare, nay, indeed exceptional, in which the criminal is subject to distorted volition, and but too frequently deem a jurist's highest earthly mission to consist in laying down his legal judgments, which start from hard and fast rules and admit of no gradations between the sane, the alienated, and the criminal mind. Hence this type of lawgiver has one sole idea, one single starting point, in assigning his verdicts. He has but one *régime* of punishment to bestow on each individual crime, and this is pronounced without preoccupying himself concerning the divergences of climate, region, and habit whence the crime has sprung. He judges the minds of others by his own, which has probably been nourished on the most sublime speculations of human wisdom. Hence, legal philosophers and legislators will not, and perchance can not, descend from the proud heights of metaphysics to the humble and arid territory of penal establishments. Their opinions on these points are, therefore, almost valueless.

In a letter recently addressed to me, in reply to my query of how he would treat the criminal, and what he thought of the Elmira system, Prof. Lombroso replied:

"To put it briefly, my idea is that so far all we have done is mistaken, not excluding from this condemnation the American reformatories. I hold that for women, for instance, except in quite a few cases (perhaps twenty or thirty, speaking of Italy), there is no need for prisons. A species of convent would suffice. For young men it is necessary first of all to distinguish the congenital criminals from those who are sons of parents affected by syphilis, or alcohol, or typhus. Then, accordingly, they should be submitted to treatment, but not a commonplace one like that of Elmira, but be dosed with homœopathic sulphur, nux vomica, or submitted to electricity. If, after such a cure, they show no signs of improvement, then detain them for life in wide islands, where, with the exception of bread and water, if they would not die, they must gain the rest of their fare by working. If, after this, they transgress repeatedly, sentence them to death. The educational reformatories, with all those precautions practiced at Elmira, I would reserve exclusively for young criminals guilty of crimes of occasion or of passion, and to these I would accord conditional liberty. The suspension of punishment, the study of the individual character, will help us to know them as much as the history of their case. Adults under judgment I would keep in prison cells whenever life in common does not facilitate the reciprocal tale-bearing which renders detection easy. But here, too, if the crime be one of occasion or passion, I would favor short-term punishments, fines, floggings, fasts, douches, etc. If, instead, the delinquency is instinctive, or recidivist, I would mostly inflict

perpetual punishment or even death, or, if the criminal be mad or a *mattoid*, put him into the criminal lunatic asylum. If his offense be political or religious, his punishment must last as long as public opinion is opposed to this form of crime."

Such, in a nutshell, are the theories which Prof. Lombroso has spent his life in expounding in writing and in speech, for whenever a specially complex case is brought before the law courts of Italy he is called in to give his scientific opinion, and his acute, shrewd, original, and penetrating judgments would, if collected, form a volume of most interesting and instructive reading, that should cause many a judge, and many a private person too, to hesitate ere pronouncing judgment. Not unfrequently he has found those to be innocent who to all appearances seemed guilty, and those to be guilty who seemed the flower of virtue. His theories are deduced from the most careful and minute observations of criminals and madmen, and it is only by studying these attentively and analyzing them that we can discover how and why Prof. Lombroso is convinced of the defects met with in all reformatories and penal houses, and by what process of selection he has arrived at his conclusions with regard to the evil and its remedies. Unfortunately, the professor, while a lucid and brilliant speaker, is a somewhat involved and arid writer, and it is no easy task to disentangle his ideas from among his voluminous and multifarious writings. Still, the study of criminal therapeutics is too interesting and too important to be neglected.

Now, Lombroso's cardinal point is, that rather than study crime when it is already mature, we should try to forestall it, if not by removing the cause, which might be impossible, at least by lessening its influence. Of course, we can not minimize such influences as the action of warm climates, the result of race, but we must adapt our laws so as to mitigate their effects by various methods, such as the more careful regulation of prostitution; the more speedy execution of justice, so that it may better impose on impressionable minds which are apt to forget the cause of the punishment if it follows the deed only after a long lapse of time; the care not to extend northward the laws which are proper to the south, and *vice versa*, and this latter especially in regard to all offenses committed against persons. Where conditions are still savage these can be much diminished by thinning the forests, the natural houses and fortresses of malefactors, by the opening up of roads, by the founding of cities and villages on sites of ill fame, as has been done in Italy to extirpate the brigands that infested certain districts; by dissolving all such societies as tend to be secret and are usually nurseries of crime (witness some of the Irish-American so-called patriotic associations), and by helping and encouraging the denunciation of evil-doers. Prof. Lombroso

also condemns very strongly and very properly the foolish habit that obtains on the European continent of extending full pardons to prisoners because a private event has taken place in a royal family, such as the birth of an heir, or the marriage of a prince. Punishment must be steady, equal, and not liable to such accidents on which the criminal, generally a fatalist, is apt to count. Further, it is always well, if it can be hindered, that a released prisoner should not return to his native place or habitual abode. A most special watch ought to be kept over the houses of receivers of stolen goods. These persons, who might be called the capitalists of crime, almost always go unpunished, and it is just they who should be smitten. The professor has great praise to bestow on the American vigilance committee, an institution he regards as wise in the extreme. He also lauds the English detection system and the Austrian *Vertraute*, who render splendid services by giving such persevering chase to criminals. He also proposes the alliance of all nations for the arrest of delinquents, as well as the sequestration of a person who boasts that he has committed a crime.

Alcoholism is a fruitful source of evil-doing. It is therefore desirable to prevent by all available means the diffusion of the liquor trade, either by exorbitant taxes or by a limitation in production. The statistics of Switzerland, Sweden, Holland, and certain parts of the United States and England show a very sensible diminution of crime since severe laws were enacted against the manufacture and sale of intoxicating drinks. Feasts, fairs, and markets should be diminished, when they are not called for by special and real commercial reasons. The mass should be educated not only by means of the alphabet, but should be taught elevated ideas with regard to work and personal dignity. Prizes should be instituted for the virtuous, and every aid should be given to extend the helpful labor of postal banks and co-operative stores. Yet another powerful incitement to crime is the public spectacle afforded by courts of justice. Entrance to these should be limited to well-known persons, and the mass be rigorously excluded. The modern tendency, fostered by the press, to make of a malefactor a hero, is greatly to be deprecated, and leads to crimes due to pure imitation, from a desire for notoriety, no matter at what cost. There should positively be forbidden those extended judicial reports in the newspapers, fruitful sources of eventual crime, which the people read with so much avidity. The State ought to promote and protect work in every way it can, for only by work can idleness be conquered, that too potent counselor of crime.

Lombroso holds that there are certain establishments where the notion of evil is first inculcated, and these, according to him,

are above all to be found in reformatories, to be commended in initial idea but to be condemned in the manner this idea is usually executed. Here, he holds, the young get to know vagabonds and idlers, whom they are drawn to copy by that instinct for imitation that exists in the youthful mind. The children associated in such places are often foundlings or the offspring of immoral families, or of parents incapable or unable to educate them. When these are brought together with children of good, honest families the latter are too frequently pushed into vice by bad example, by acquaintances made in undesirable places. It is undoubtedly our duty to care for the orphan and the foundling, but we must be careful above all to prevent their being dragged into guilt as well as to lift up those that may have fallen into it. It is from this very aim, as Lombroso knows, that has arisen the idea of reformatories and houses of custody for the young, which in France receive annually 7,685, in Italy 3,770, in Belgium 1,473, in Holland 161, and in America 2,400 individuals. But their utility, the professor holds, is not apparent. They have been founded in a frame of mind more benevolent than well informed as to the criminal nature. Too many and too complex are the causes, multiplied by mutual contact, of the evil they would cure, and this too at an age not tender enough to model, yet young enough to be expansive and inclined to imitation, especially of evil.

The over-agglomeration for economical reasons of individuals, and the admission into public reformatories of the worst subjects expelled from private establishments, annul every attempt at reform. Statistics show but too plainly the falling back into evil courses of the inmates of such institutions. The diminution in England of twenty-six per cent, which is attributed to the one hundred and seventy-two reformatories which she owns, Lombroso would assign instead rather to the diffusion of the twenty-three thousand so-called "ragged schools" that take care of millions of young people during the most dangerous age. In Italy, says Lombroso, it is too easy for fathers and guardians to place sons and wards in reformatories under pretext that they are wicked; and certainly it is not there that they will amend, since in such places there can not be carried into effect the nightly cellular system and the enforced silence which are an absolute necessity for rigid discipline, and to counteract the worst vices of the young criminal. From his own observations Prof. Lombroso is convinced that even in the so-called best-managed reformatories there prevail the worst sexual vices, not to mention theft, the *camorra*, such as is carried on in the penal hulks, the learning of the criminal jargon, the tricks of the trade, tattooing, and all other distinctive vices of criminal men. What remedy lies to hand? Prof. Lombroso writes, in his Uomo Delinquente,

"Charity, or rather foresight, must assume new forms, leave the ways of alms and the violence of prisons, and substitute spontaneous asylums and industrial schools."

Lombroso explains in detail what admirable work the New York "Society for the Reform of Youth" has done since 1853, by founding industrial schools and lodging houses; implanting the love for work in bad boys, giving them the knowledge of personal liberty, and the healthy desire to better their state by employing them in factories and workshops. He holds that Italy might advantageously copy and imitate such a reform, particularly in Piedmont, Sardinia, and the Valtellina, where sheep-tending utilizes the children.

When offenses in youths pass a certain limit so as to require heavier punishments, Lombroso contends that above all things the so frequent method of often-repeated and short-term imprisonments should be avoided with the greatest care. Instead, a graduated punishment should be substituted, like fasting, douches, forced labor, and isolation in their domicile; or, if it is preferred, fines might be imposed, thereby lightening the cost of maintenance. A money fine has also the great advantage of touching the modern culprit in his most vulnerable point.

If the crime be serious, then, according to Lombroso, prison cells are necessary in order to isolate the culprit from his companions. But our chief and primal aim should ever be education. We should strive to inoculate the delinquent with more than mere alphabetical instruction, we should teach him the practical knowledge of useful trades, and instead of futile preaching and moral teaching we should give him good or bad marks; passing him into privileged categories where he would have the right, for example, to wear a beard, receive visits, work for his own benefit, and so on. Thus, through those very passions which left alone would lead him on to greater wickedness, we must seek to inspire him with the need of honesty. Ferri tells of a thief who became an honest man when the Sister of Charity, with that very end in view, intrusted him with the care of the prison wardrobe.

Overstrictness is always harmful. It is far better to tickle the vanity of the prisoners—a feature highly pronounced in the criminal type—by permitting them to elect among themselves wardens and teachers, as well as arbitrators who shall decide concerning the misdeeds of their companions. This would help to awaken a spirit of comradeship, which is always beneficial. Lombroso inclines somewhat to Despine's method of not inflicting punishment until a little time has elapsed after the committal of the offense, to allow passion to cool down, if the offense be due to this cause.

With regard to employment for prisoners, all outdoor work is to be preferred; next come the works in straw, cord-making, broom-binding, typography, tailoring, terra-cotta molding, then last of all shoemaking and carpentering. To be absolutely avoided, because they open the way to new crimes, are such trades as blacksmiths, photographers, lithographers, and such like, wherever iron implements or chemicals must be utilized. Work must be proportioned to the strength of the prisoner; prison work should on no account be farmed out to contractors *et pour cause*, because these would naturally always protect the ablest men and not the most morally deserving. "Never impose work," says Lombroso; "let it be desired. The delinquent should ask for it, and having obtained it, it should never become for him a pretext for receiving greater privileges." The Elmira Reformatory, of which Lombroso speaks in the letter I have quoted, has, we know, served as a pattern to all penitentiaries in the United States, and has modified their methods. Mr. Brockway, its founder, who states that he imbibed all his ideas from Lombroso's Uomo Delinquente, started from this premise that the introduction of indefinite and unlimited punishment is necessary as the basis of a logical and efficacious moral system; that it is not enough to separate the congenital criminal and the occasional, the passionate, and instinctive, that to each one must be applied the cure that best suits him, as in a hospital each patient is treated in a particular manner. The physical treatment is directed toward the development of muscle, by means of douches, massage, gymnastics, and good diet. In the moral it aims at the strengthening of the will, teaching the prisoner self-control, and thus enabling him to hasten on his own liberation, which is granted as soon as he has proved himself to be worthy. Mr. Brockway divides the prisoners into three classes—good, moderate, and perverse; but from the last they can pass into the first through good behavior, love of work, and respect for the guardians. The work taught in Elmira is practical; the prisoner, as soon as he is liberated—and this, according to statistics, is very soon—will always find lucrative occupations. Self-respect once born within him, will go on increasing, unless he is a delinquent born, and here it is that Lombroso departs from Mr. Brockway; in that case he insists that every remedy will be vain. The criminal will eventually fall back, and only complete exile or death can save society from his disastrous operations. But in spite of this objection Lombroso holds that Mr. Brockway's system, subject to a few modifications, which would take us too long to examine in detail, is useful as far as it goes in the present incomplete and chaotic state of equity in which scientific laws and legal justice do not correspond in their actions. He holds that it is particularly to be commended for

juvenile delinquents, whom a gentle, loving care will rehabilitate better than a severe prison *régime* conducted on the old lines. Lombroso is greatly in favor of the Irish graduated cellular system, by which the culprit regains little by little an almost complete liberty. In this wise there results to the state a sensible economy—a fact not to be despised, seeing the large cost to society of these useless members of the body politic. He also lauds the Danish system, another graduated method founded on repaid labor, and provisional and conditional liberty. Nor does he forget Saxony, where the system which he calls "of individualization" has given such excellent results.

He strongly urges that on quitting prison the interest only of the capital he has acquired by his labor should be accorded to the prisoner. This will help to keep him straight, and retain him under a moral control. The professor is absolutely opposed to deportation to colonies. For the incorrigible delinquent, Lombroso counsels, as the only way of supplanting capital punishment, to which in extreme cases he is not opposed, a perpetual exile from society, into which the criminal will not be able to return unless he gives irrefutable proofs of amendment.

"No matter that their criminality springs from infirmity," he writes, "they are equally dangerous to themselves, to us, and to their offspring; and their rigid isolation is more useful and less unjust than that of lunatics."

And this brings him by a natural transition to the very important question of criminal lunatic asylums, institutions counseled by humanity as well as by social security. Among delinquents, and those believed to be so, there are many who are and always were demented, and whom to imprison would be to treat unjustly. In Italy such persons are as yet provided for only by half measures which violate both morality and security. In England they have attempted for a century, and for sixty years have almost succeeded, in settling this question by instituting criminal madhouses. In 1786 this species of lunatics were confined in a certain part of Bedlam; in 1844 the state undertook to maintain two hundred and thirty-five in a private establishment in Fisherton House, but as the sad bands of those unhapy ones grew it ended by erecting special madhouses. In 1850 one was opened in Dundrum for Ireland, followed by one in Perth for Scotland, and in Broadmoor for England. In these houses, regulated by suitable decrees, admission is given not only to those that have committed crime in an access of madness or who have become mad during their trial, but there are also shut up those that on account of lunacy or idiocy are incapable of undergoing prison discipline. In America this reform has already brought about the criminal asylums of Auburn, in Pennsylvania,

and in Massachusetts. In Italy most of these unhappy creatures are held to be lazy, riotous, perverse, or deceitful, and when their lunacy is admitted it is difficult to obtain their admission into asylums, and this because this special class of lunatics are dangerous inmates for ordinary madhouses. They steadfastly resist all discipline, they permit themselves obscene and violent acts; they are discontented with everybody and they evince themselves indifferent to punishment; in a word, they carry into the madhouse the habits and vices of the immoral class from which they spring, and thus become apostles of sodomy, rebellion, robbery, and desertion, to the detriment of the establishment and of the other lunatics. Often, too often Prof. Lombroso says, such men are allowed to wander free in the midst of society, and are the more dangerous because under an apparent calmness and lucid intelligence they retain their diseased impulses, giving proof of this when least expected. The professor cites several examples, and holds that to men thus mentally afflicted are due the epidemical madnesses that show themselves in the form of Nihilism, Mormonism, Anabaptists, the incendiaries in Normandy of 1830, and the Parisian Commune.

He insists rigidly on the point that this institution of criminal lunatic asylums is not due to sentimental pity, but is a pure measure rather of social precaution than of humanity. And against the objection that might be raised that real madmen may be confounded with dissimulators, Lombroso sets the development of modern anthropologic studies, which rarely, when the diagnosis is carefully made, falls into error on this point. By the institution of criminal lunatic asylums we obviate the transmission of the disease to offspring, we hinder recidivism and its consequences, which at best lead to the heavy cost of a new trial for the criminal. And that the theory is proved by practice to be correct is evinced by the fact that gradually the objections of adversaries are being overcome, so that criminal madhouses, under different forms, are being established in Denmark, Sweden, and France, where, since 1876, there exists one at Gaillon annexed to the central prison. The other civilized peoples of Europe, if they have not real criminal madhouses, have certain laws and institutions that in part answer the same purpose, as in Belgium, at Berlin, Hamburg, Halle, and Bruchsal. In Italy not only are there no such special establishments, but there is not even a line in the codex admitting the possible necessity for any such institution. Prof. Lombroso invokes these salutary provisions in ardent terms. He writes: "The orbit of crime is too deeply engraved in the book of our destiny for us to delude ourselves that we can suppress its course. But if other undisputed laws do not fail us, like those concerning the selection of species, we may hope by such prevent-

ives to moderate the effects of crime and to hinder its widespread diffusion."

Deterrents, preventions—these two words may be said to be the keynote to Lombroso's system. If he have a favorite proverb, it is certainly that "prevention is better than cure." On this account he would segregate from society the adult criminal, in order to deter him from exercising his pernicious instincts, and he would direct his chief and best energies to the rising generation.

Can we make it possible for a child that has criminal tendencies not to become a criminal? This is his chief problem, and this question he answers with a decided affirmative.

So long as the criminal acts are not repeated to excess, and when they are not accompanied by all the anthropometrical characteristics of criminality, there is hope to be found even in this dismal science. The evolution of good takes place in a sound man in spite of a bad education. Anticriminal education must, therefore, begin as soon as the first pernicious symptoms show themselves; on the other hand, excessive severity must be avoided, and more must not be asked of the child than it can do. The more gentle the corrections, the more efficacious will they prove. For example, if the child has spoiled a favorite object, buy it again at your own expense, but deprive him of some sweetmeat, some amusement. If he dirties the house with his games, let him repair this evil; never mind if it draws down on him some scalds and scratches; only let him have been advised beforehand to avoid the deed, and told what consequences would follow disobedience. When he does not obey orders, show him less sympathy, but never fall into a rage, for anger is as harmful to the parent or guardian as to the child. A useful reaction only follows when the punishment is given in a calm spirit. Above all, endeavor to get the child to correct itself rather than to depend on the violence of a monitor. One should prevent rather than encourage in children, as is done by the majority, the constant association of the idea of punishment with a bad action. In consequence, when the time has come to liberate him from the leading strings of master or parents, he is no longer afraid of committing offenses, thinking they will now cease to carry judgment in their train. This constantly happens to children of overstrict parents, who when grown up and independent are apt to commit great misdeeds and even crimes.

These reasons are doubly applicable to young criminals, who can not be properly watched and educated in reformatories on account of the large number of their inmates. The divisions and subdivisions admitted of in such places are not sufficient to cover all the varieties of bad tendencies a child with criminal instincts

will develop. This is one of the most salient points of the problem. Lombroso cites an experiment made by a naturalist who placed together in an aquarium, divided only by a piece of glass, some carps and some of the little fishes they eat. At first the carps knocked violently against the glass to catch their prey, but after a while, seeing that their attempts were vain, they abandoned them, and when after a while the glass was removed they lived together in harmony. By habit they became innocuous if not innocent. So also the dog by custom and education ceases to steal. It is by such methods that Lombroso holds that congenital criminals must be cured, and not by baths and gymnastics or "collegiate prisons," which are powerless to affect moral habits.

These new theories and systems have ardent followers, but obviously also encounter violent opposition.

To Italy, to her honor be it said, belongs the due that she was the first in Europe to instigate and propagate the study of criminal anthropology. It may indeed be claimed for her that in that fair land the positive method is of ancient origin and that it sprang up in the Renaissance with Galileo. It attracted less attention as long as it was limited to the physical and natural sciences; but when it was carried into the moral and social field it awakened diffidence, and of this diffidence the effects were felt by men like Claude Bernard and Comte, in France; by Spencer, in England; by Lombroso and Garofalo, in Italy; and by Wundt, in Germany. But all the men, nevertheless, pursued their course undaunted. Indeed, most of them hold, and Lombroso above all others, that all this opposition on the part of their adversaries is desirable, as it spurs on to new exertions and helps to emphasize the deductions of the positive school, based as they are on minute anthropological researches.

Lombroso's firmness of purpose in the pursuit of his studies may best be estimated by quoting his own words with regard to his life's work:

". . . me rallier sans convictions au jugements du public moyen, en venir au moindre compromis pour l'amour de la paix, m'arrêter un seul instant dans le travail incessant de renouvellement juridique et psychiatrique, auquel je me suis voué; ce serait non seulement m'avouer vaincu, mais ensevelir avec moi tout le travail de ma vie. Jusque-la n'irait pas même l'abnégation . . . la plus chrétienne."

Surely he is a worthy successor and compatriot of Galileo. Even that great blind scientist spoke no prouder words when, tortured by rack and priests, he muttered, "*Eppur si muove.*"

ANTHROPOLOGY AT THE WORLD'S FAIR.

By Prof. FREDERICK STARR.

EVERY great international exposition is, in a certain sense, a practical study in anthropology. Recent world's fairs have, however, shown more and more a tendency to make an especial exhibit in anthropology and kindred sciences. This was very noticeable in 1889 at Paris, and in our own World's Columbian Exposition there is an especial department—Department M—of Anthropology, under the directorship of Prof. Frederick W. Putnam. A building has been erected for its purposes, and the larger part of it is occupied in illustrating "man and his works." Naturally, to this building the student in anthropology will first turn in looking up the matter of anthropology at the fair.

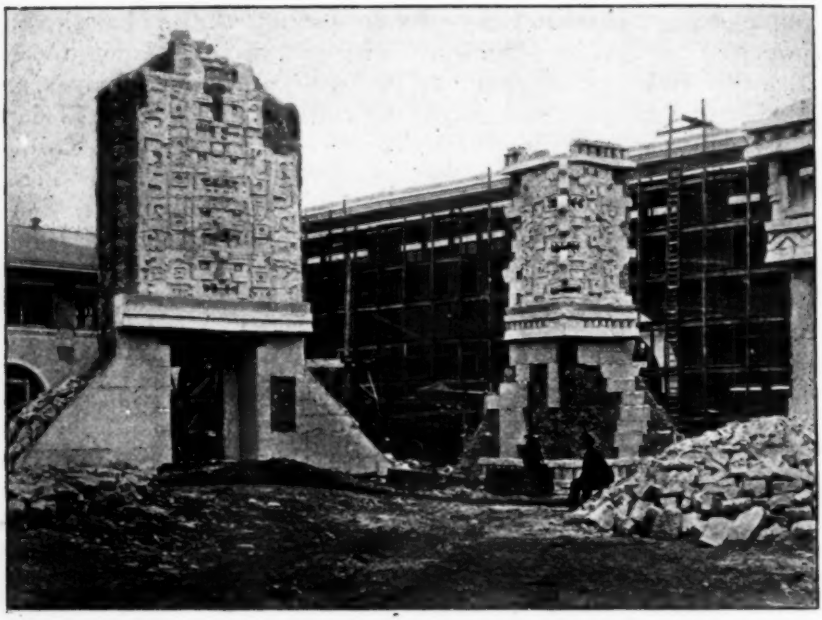
In this building he will find collections in ethnography, in archæology, and in physical anthropology. As one passes through the main entrance he sees reproductions of Assyrian sculptures; to the right are collections in North American ethnography; to the left series illustrating North American prehistoric archæology. Among the notable private collections illustrating the ethnography of our American Indians are those of D. B. Dyer and Edward E. Ayer. Mr. Dyer's collection is mainly representative of plains tribes, and is rich in cradles or papoose-boards and in implements for gambling. Mr. Ayer's collection is from a larger range of peoples and represents quite fully the dress, implements, and arts not only of the plains tribes, but also of the peoples of the Northwest coast and of the Southwest. His collection of modern Pueblo pottery, the straw dresses of the California Indians, the carved work from the Northwest coast, are of special interest. Near these collections is the large series from the Northwest coast gathered by Dr. Franz Boas and his helpers, particularly rich in dancing paraphernalia, masks, bark necklets, and the like. On a raised platform, extending for many feet, near this, Dr. Boas has set up a reconstruction of the village of Skidgate, one of the most important villages of the Haidah Indians. The models of houses and totem posts which make up this reconstruction are of native workmanship.

Among the archæological collections are some of unusual interest. Prof. George Frederick Wright, of Oberlin, illustrates the material and structure of the terminal moraine of the United States by specimens of bowlders, striated surfaces, photographs, and diagrams. The exhibit is made with reference to the question of palæolithic man in America, and in the collection are pictures representing localities where claimed "palæoliths" have been found. The largest collection of implements from glacial gravels in this

country is that of the Peabody Museum at Cambridge, and a series is here shown from that institution illustrating the finds from the now famous localities in New Jersey, Ohio, Delaware, etc. Of considerable importance is the small, carefully selected, and neatly displayed collection from the Canadian Institute of Toronto, which is rich in rare forms of bird amulets, gorgets of striped slate, pipes of stone, and bone implements. The State Historical Society of Missouri exhibits a handsome series of the white chert implements so characteristic of that district, as also hematite objects and fine mound potteries. In cases near by is a magnificent series of Wisconsin copper implements—spear-points, knives, arrowheads, etc.—partly displayed by the State Historical Society and partly private property. Colorado sends a considerable display of cliff-dwelling relics. Of prime importance is Mr. Warren K. Moorhead's gathering from the mounds of Ohio. Mr. Moorhead was sent by the Exposition management to the district rendered classical for American archæology by the work of Squier and Davis. He was successful beyond all expectation, and here are gathered the results of his excavations—hundreds of spool-shaped ear ornaments of copper, mica ornaments, wonderful blades of obsidian from altar mounds, stone pipes, thousands of chert disks from one mound, a find of copper ornaments surpassing any ever found before in American mounds, an antler-form headdress unique in shape and character. Besides these, Mr. Moorhead has made a reconstruction of one of the very interesting stone graves of Fort Ancient, with the skeleton in its proper position. In connection with this important series it should be mentioned that Prof. Putnam has near it several models of important mounds, the most interesting representing the famous serpent mound of Adams County, the preservation of which is due to an interest aroused by Prof. Putnam in the ladies of Boston. The model aims to reproduce not only the mound itself, but also the topography and conditions of the surrounding country.

Of foreign countries, several are represented in this building by collections, ethnographic or archæological. The explorations of Charnay, of the Peabody Museum, and others in Yucatan, Honduras, etc., are illustrated by a magnificent series of direct reproductions in plaster. The wonderful wall carvings of Lorillard City, the zapote wood carvings of Tikal, the strange monoliths of Copan, are all here to be seen, true to life; elegant photographs and fine enlargements, the result of Mr. Saville's recent work in those districts, represent Uxmal, Labnah, and Chichen-Itza accurately. With this wonderful series from Yucatan and its neighborhood is Mrs. Nuttall's interesting exhibit of Aztec shields. It will be remembered that this lady recently discovered in the old castle of Ambras an ancient Mexican feather-covered

shield. These objects are exceedingly rare, and the discovery led Mrs. Nuttall to make a careful study of the whole subject of Mexican feather shields. The exhibit consists of a copy of the shield at Ambras, and the reproduction of a considerable number of others from pictures in the old pictographic books of the Aztecs. Near this section is an exhibition of the archæology of Peru. Mr. Dorsey was sent out by the Exposition management to make



RESTORATION OF MAYA RUINS (YALE). World's Columbian Exposition.

collections in the land of the Incas. A considerable number of graves were opened and much material was secured. Several table cases contain the results, and in two inclosed spaces Mr. Dorsey aims to show the old Peruvian method of burial. Mummies in their original wrapping are set in their proper position, together with all the funereal furniture—the face-mask, the square cloth-covered tablet, the articles of daily use, the pottery and ornaments. Mr. Dorsey exhibits in one table case a very interesting little collection of broken pottery and engraved stones from a new locality, La Plata Island, in Ecuador, which bids fair to be a spot of importance to future investigators. Besides these interesting series secured by the efforts of the management of the Exposition, there are exhibits by Costa Rica, Mexico, Paraguay, and New South Wales. Costa Rica's display deserves more than a passing word. A neat pavilion, with walls adorned with oil paintings illustrating natives of the country and points of archæological

interest, contains several cases in which a series of specimens selected from the National Museum illustrates the ancient pottery, stone implements, and carvings of the country. Mexico gives a display neither full nor satisfactory, in part ethnographic, in part archæologic. Here are trophies composed of reproductions of ancient shields, spears, and battle clubs; here are models of old buildings of the Mexico of Cortés; here are a few original specimens in archæology and many plates from a work on Mexican antiquities. So much might have been done; so little really is done! Paraguay sends a considerable ethnographic display, particularly rich in feather work, in nettings, and in spears. New South Wales sends carved work from the south seas, especially the characteristic black, shell-inlaid work from the Solomon Islands, boomerangs from Australia, spears, bark cloth, etc., from various localities. Most important of all, however, are the magnificent great photographs representing natives, wild life, and arts of the south sea islands and Australia. Mr. Culin, on his own behalf and for the American Folk-lore Society and the University of Pennsylvania, displays a collection of games and some objects connected with worship. The series of games is particularly interesting, and represents the indoor pastimes of all peoples and all times.

In the north gallery of the Anthropological Building is a most important laboratory and exhibit in physical anthropology. The laboratory itself falls into three subdivisions: Physical anthropology (somatology), neurology, and psychology. Dr. Franz Boas has general charge of the whole, while Prof. Donaldson (Chicago) has charge of the subdivision of neurology and Prof. Jastrow (Wisconsin) directs the work in psychology. There are a number of rooms devoted to these laboratories. First there is presented a series of instruments used in anthropological investigation—anthropometric machines, craniometric instruments, instruments for drawing skulls, outlines of the body, etc. The types of mankind as found in Europe, the south sea islands, America, etc., are shown by portraits, masks, diagrams, maps, and other material. Composite photography, as applied to finding types and in the study of crania, is illustrated. Francis Galton's method of taking finger prints is illustrated and a considerable series of impressions taken from the finger tips of Indians of North America by Frederick Starr and Mr. David Barrows is displayed. Here also are the results of Dr. Boas's recent investigation into the physical structure of the North American Indian. A number of observers were sent to take measurements among our native tribes. Many thousand sets of measures were taken. Each set comprised a dozen measurements and descriptive matter covering about thirty points. This mass of material has been

studied carefully, tabulated, and reduced, at least in part, to graphic form. Diagrams show the distinctive characters of tribes and the effect of environment, the influence of crossing, and the like. Maps instructively show the variation of stature and other characters with changes in physical geography. In neurology Prof. Donaldson, by a series of models and casts, represents the brain form in man and lower animals, the structure of the brain, localization of function, and modes of brain preservation for

HOUSE OF KWAKIOOLS (VANCOUVER ISLAND). World's Columbian Exposition.

study. Prof. Jastrow's two rooms are of great interest: in one, arrangements are made for conducting the various tests of so much importance in modern psychological study; in the other, in a series of cases, is a full representation of the instruments and apparatus used in experimental psychology—instruments for investigating the senses of touch, light (color), hearing, etc., as well as for recording, timing, and the like. All these laboratories are expected to be in operation, and observations and experiments will be conducted by a corps of student assistants.

Near the Anthropological Building are several outdoor displays of more than usual interest. The party sent out by Prof. Putnam to the ruins of Yucatan and Copan secured at Uxmal, Chichen-Itza, and Labnah "squeezes" of some doorways, corners, arches, etc., showing every detail of ornament and symbolical carving. From these molds casts have been made exactly reproducing the structures. A group of five of these lies north from the Anthropological Building. North from this is an interesting series of homes of various American Indians. The palm-thatched hut of the Arawaks of Guiana; the long house of the Iroquois, constructed of bark, and divided into six spaces within, one for each of the Six Nations; the birch-bark tent of the Penobscot Indians of Maine; the skin-covered tepee of the plains tribes; the dome-shaped framework of poles, covered with rush matting, of the Algonkins; the plank-covered houses of the Kwakiool of Vancouver Island, and the Haidah of Queen Charlotte Islands with their symbolical paintings and totem posts; these range along the edge of the lagoon on whose waters float various canoes and boats of the natives. These houses have been built from proper materials by the Indians themselves, and most of them are inhabited by families of Indians, some of whom carry on their native arts and industries. Very interesting in this connection will be the series of dances of the Kwakiools, for which Dr. Boas has arranged, which will take place at intervals through the season.

Most interesting material is found in the United States Government Building. The National Museum, through Prof. Mason, has set up a suggestive series illustrating the groups of Indian tribes. A great copy of Powell's Linguistic Map of North America upon the walls represents the groups of tribes as classified by language. In alcoves below, cases full of objects illustrate the arts and industries of these groups. It is most interesting to notice how clearly the influence of environment and the gifts of Nature is shown in the arts and industries. Tribes speaking languages of one stock may show marked diversity in arts if living in unlike surroundings, while tribes widely differing in language may show industrial unity if subjected to similar environments. Very interesting to the crowd are the cases wherein are displayed life-size figures dressed in costumes. Some of these are particularly pleasing: the Xivaro, with his feather belt and crown; the Chippewa blanket painter; two plains Indian women dressing a buffalo hide—one kneeling before a hide hung upon poles scrapes it, while the other pounds a second hide with a stone maul; a Moki man drilling a turquoise bead with a pump-drill; a Sioux squaw and children on a pony dragging the *travois;* a Mojave man with apron of bark strips, head feathers, and a shell orna-

ment; a Hupa woman and girl in straw caps and dresses, with a papoose in its pretty basket cradle—these and other carefully chosen and usually well-executed groups give life, reality, and meaning to the objects in the cases around.

In a large alcove near by, occupied in great part by models of cliff-ruins, pueblos, and other monuments of the Southwest, are two interesting exhibits from Mr. Thomas Wilson, of the Smithsonian Institution, and Mr. William H. Holmes, of the Bureau of Ethnology. Mr. Wilson aims to present a synopsis of prehistoric archæology. The relics of palæolithic man from France, England, Egypt, and India are fairly represented. Next to them are placed some of the claimed palæoliths of New Jersey and Minnesota. Rude implements of forms akin to palæoliths but of uncertain or negative geological relations from all parts of the United States follow. A good neolithic series from the Swiss lake dwellings and the tumuli of Denmark is shown. Fine specimens illustrate work in polished stone in America. The bronze age in Europe, illustrated by objects from Switzerland, France, etc., is set alongside of objects of copper from American mounds and bronzes from Mexico. Some of the finer objects in jade, quartz, crystal, and obsidian from Mexico, and stone collars and mammiform stones from Porto Rico, complete the exhibit. Mr. Holmes's series is intended to illustrate Indian quarrying and mining. It is altogether a model display. The now famous quarry at Piney Branch, near Washington, is first illustrated. On this site the Indians formerly quarried pebbles, from the gravel deposits, for making into implements. These pebbles were worked up into "blanks"—oval or leaf-shaped—from which, later and elsewhere, spear-points, arrowheads, and the like were made. In making these blanks many pebbles would be found to be worthless and would be rejected. These rejects and the blanks themselves closely resemble our American "palæoliths," and Mr. Holmes believes that some at least of our American palæolith localities are old quarry sites, and that the palæoliths themselves are rejects. There can be little doubt that the showing of this idea has much to do with the making of this display. The exhibit, however, is so complete and excellently worked out that it has profound value apart from any theoretical interest. In regard to Piney Branch Mr. Holmes displays in table cases a series of pebbles, rejects of every stage, and blanks; along the wall above are specimens showing every stage from the pebble, through the blank, to the arrowhead or spear-point. Above this series are framed diagrams, sections of the quarry, and maps, also a fine series of photographs. Clear, explanatory labels accompany all. In exactly the same way Mr. Holmes illustrates an interesting quarry of chert in Peoria Reservation, Indian Territory; the novaculite quarry of Arkansas; the

GROUP OF KWAKIOOL INDIANS (VANCOUVER ISLAND). World's Columbian Exposition.

chert diggings of Flint Ridge, Ohio; the rhyolite quarry of Pennsylvania; and the quarry of flint nodules in Texas. These all differ from Piney Branch in that the material is quarried from solid rock ledges, not from soft gravels. The quarrying of soapstone in the District of Columbia and the making of it into bowls, the mining of copper in the Lake Superior district, and the taking out of the famous red pipestone from the quarry in Minnesota are all illustrated in the same complete fashion. As a representation of an important and interesting aboriginal industry nothing could be better.

The anthropologist finds two collections of interest in the Woman's Building. In a dozen cases Prof. Mason shows "woman's work in savagery." The development of personal decoration, the preparation and serving of food, the making of basketry and matting, embroidery and needlework, beating of bark cloths, weaving by hand frames and looms, dressing of leather, and pottery-making are the chief points represented. The fact that woman has been the chief actor in originating and developing every peaceful art is impressively shown. By the side of this series is Mrs. French-Sheldon's collection. Every one knows of this woman's exploration of East Africa. With no white companions, with an escort of hired porters and guides under no command but her own, she penetrated a thousand miles into Africa, among tribes some of which, like the Masai, were on a war footing. She has brought out from the dark continent thousands of objects illustrative of the daily life, the arts, and culture of the natives, and here one may see them displayed as a monument of a remarkable undertaking. Fine shields, carefully leaf-shaped spear-heads of iron, objects of personal adornment, native dress, wood carving—these are but a few of the many objects. Mrs. French-Sheldon herself is frequently in attendance, and proves as much of an attraction as the collection.

The student of culture-history must find objects of interest everywhere, frequently where one would scarcely expect them. Thus the Baltimore and Ohio Railroad makes a wonderful exhibit, under the title of The World's Railway. A magnificent series of pictures, models, and original specimens illustrate the whole history of the development of the locomotive, the cars, and the tracking. In the Shoe and Leather Building colored pictures and many wall cases full of specimens show the footwear of all ages and all peoples.

At Paris one of the most attractive features was the representation of outlandish peoples. At Chicago the Midway Plaisance supplies the opportunity to see many strange sights. The German village and Old Vienna are true architectural reproductions. The Chinese theater and its temple annex, with the native

music and the long plays, give an opportunity, rare east of California, to see the dramatic art and religious rites of the Celestials. The Dahomey village, with mud-daubed huts, on which are scraped queer animal and bird figures, and its war-dance on a central platform, gives a real glimpse of negro Africa. The street of Cairo, narrow, crooked, with its bazaars, shops, and booths along both sides, its donkeys and camels, its school with children crying the Koran aloud, and its juggler plying his mystic trade, attracts great crowds. The Egyptian temple with its dancing dervishes, a Lapland village, Javanese village, Polynesian settlement, Algerian and Turkish theaters are among the other attractions on the Midway Plaisance where one may study ethnogra-

ESKIMOS FROM LABRADOR. World's Columbian Exposition.

phy practically. Two concessions of unusual interest are not on the Plaisance, but in the main Exposition grounds. These are the Eskimo village and the cliff dwellings. The Eskimo village has been located for a long time; and last winter, when snow filled the air and the pond was ice-covered, its inhabitants were a happy crowd. They amused themselves and their visitors by sledding with dogs, skating on old wooden runners, and whipping pennies with their long-lashed dog-whips. Several babies were born in the village, and some died. One little fellow, Christopher Columbus, was an especial pet with visitors, and managed to live despite the many attentions he received. Dressed in their furs these people looked truly polar, but we are assured that as spring came on

they rebelled against wearing these heavy garments, which were unlike anything they ever wore before. It seems they came from a part of Labrador often visited by vessels, and are used to clothing made of white men's cloth. The cliff dwellings are located near the Maya ruins, and are the work of Mr. H. Jay Smith. They appear externally like an irregular mass of reddish-brown rock, with mule tracks winding up its sides. Entering it, we find ourselves in a great cavern, lighted from above, in which are excellent reproductions of the cliff dwellings of the Southwest. Several of the more famous ruins are here presented, made to scale sufficiently large to be truly impressive. Further in are single rooms, or small clusters of them, with fireplaces, T-windows, and other details reproduced in full size. A great hall cased along the walls is devoted to an excellent collection of objects from the ruins — stone implements, fire-sticks, fabrics, feather clothing, sandals of yucca fiber, dried bodies (mummies), some still in their original wrappings, pottery in many fine and rare pieces, food materials, etc. The idea is a good one and the execution creditable.

Comparatively few governments can be said to present in their exhibit a complete picture of their life and thought. One land, however, makes an exhibit most full and interesting—Japan. Early in the history of the Exposition the Land of Sunrise showed its interest. It is represented in nearly every department. Its fine-arts display includes choicest treasures; in the liberal arts are marvels of work in lacquer, bronze, porcelain, and silk; in the Horticultural Building is one of the marvelous gardens of Japan, with its elements grouped to form a miniature landscape—a fish-pond, rustic bridge, pretty wreaths of fern roots clothed with green, stone lanterns, and wonderful dwarfed aged evergreen trees; the agricultural display, showing not only the products themselves, but the tasteful packing and preparation of them for use—tea boxes (beautiful whether plain or elaborately decorated), tea in jars with silk covers and finely tasseled cord; *sake*, or rice wine, in elaborately lacquered jars; fibers, cloths, vegetable wax, barley honey, candies, mattings, silks; in the Forestry Building are the various woods used for all purposes, and a set of curious native pictures representing scenes in the lumber camps. Besides all these beautifully complete and daintily arranged displays, the Japanese have erected on the wooded island a group of three buildings called collectively the Hooden. They are copies of three famous buildings—a monastery of the Zen Sect, at Kioto, erected in 1397; a structure dating from 1052, representing the phœnix; and the main building, a palace of about the time of Columbus. These are of Japanese material, built by Japanese carpenters, and are of exquisite workmanship. They have been presented by the

Government of Japan to the city of Chicago, and are to be kept filled with interesting collections, which will be changed from time to time. To visit these various exhibits of Japan is to gain an insight into most delightful features of Japanese art, life, and character.

Although results of great importance to anthropology in America must result from all this display of material, it is believed that other permanent results must come from the congress and the library. In August an International Congress of Anthropology is planned. To it are invited the world's workers in the science, and before it are to be read important papers. The American Association for the Advancement of Science, the American Folk-lore Society, and the American Psychical Society unite in seeking the interests of this congress, and from it should come decided impulse to our anthropological work. As to the library, Prof. Putnam has issued an appeal to anthropologists asking contributions of all they have written in the science as a donation to a permanent library of that subject, to be located in Chicago, in connection with the Memorial Museum. The collection is to be catalogued and the catalogue published. Should this plan be carried out, the catalogue would be the best reference list to anthropological literature ever prepared.

It must be plain that in the Chicago Exposition we have a great object lesson in anthropology: a museum of somatology, archæology, and ethnology; a picture of ethnography; a laboratory of unusual completeness; a great meeting of workers; and the publication of new material.

A NOTE presented in the French Academy of Sciences from Dom D. Démondin relates to the manifestation of sudden variations of temperature at fixed times in the latter half of January, as observed during more than six hundred years past. The author has examined with regard to this subject meteorological notes recorded between 1582 and 1879, or during about three hundred years; and for the preceding three centuries he has consulted various public documents, particularly the Annales des Dominicains de Colmar, from 1211 to 1305. He has thus verified, as for the centuries included, alternations of temperature marked by a depression about the 18th and an elevation toward the 23d and 29th of January, the temperature continuing low during the intervening days.

IT has been suggested by Colonel H. W. Feilden that the musk ox might with great advantage be introduced into Great Britain; and the author sees no reason why it should not thrive on the mountains of the Highlands in Scotland. It is covered in the winter season, besides its coat of hair, with a long-stapled fine wool, of a light yellow color, and as fine as silk. Sir John Richardson says that stockings made from this wool are handsomer than those from silk. Young musk oxen are easily reared and tamed, and could probably be procured from the arctic regions without great difficulty.

RECENT SCIENCE.

By PRINCE KROPOTKIN.

II.

AT one of the recent sittings of the French Academy of Sciences, Henri Moissan, whose name has lately been prominent in chemistry in connection with several important discoveries, read a communication to the effect that he had finally succeeded in obtaining in his laboratory minute crystals of diamonds.* His communication was followed by a paper by Friedel, who has been working for some time past in the same direction, and has attained similar though not yet quite definite results; and, finally, Berthelot, who also was working in the same field, but followed a different track, announced that, in view of the excellent results obtained by Moissan, he abandons his own researches and congratulates his colleague upon his remarkable discovery.

The discovery is not absolutely new, and the French chemist himself mentions two of his English predecessors. Mr. Hannay obtained in 1880 some diamondlike crystals by heating in an iron tube, under high pressure, a mixture of paraffin oil with lampblack, bone oil, and some lithium;† and in the same year Mr. Sidney Marsden, by heating some silver with sugar charcoal, obtained black carbon crystals with curved edges.‡ Besides, it was generally known that a black powder, composed of transparent microscopical crystals having the hardness of diamond, is deposited on the negative electrode when a weak galvanic current is passed through liquid chloride of carbon. But these crystals, like those of Mr. Marsden, belong to the easily obtained variety of black diamonds known as carbonados; while some of the crystals obtained by Moissan are real colorless and crystallized diamonds—the gem we all know and admire.

For industry and every-day life the infinitesimal quantities of diamond dust obtained by the French chemist may have no immediate value, and some time will probably be required before a modest-sized jewel is made in a laboratory. But the discovery has a great scientific interest, inasmuch as it is the outcome of a whole series of researches which have recently been made with the view of artificially reproducing all sorts of minerals and rocks, and which are admirably chosen for ultimately throwing new light upon the intimate structure of physical bodies.

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* Comptes Rendus de l'Académie des Sciences, February 6, 1893, tome cxvi, p. 218.

† Proceedings of the Royal Society, xxx, 188; quoted by Moissan.

‡ Proceedings of the Royal Society of Edinburgh, 1880, ii, 20 (Moissan's quotation).

Moissan's method is based upon the capacity of iron of absorbing carbon at a high temperature and of giving it back in the shape of grains and crystals while the iron mass is cooling. When iron has been saturated with carbon at a temperature of about 2,000° Fahr., a mixture of amorphous carbon and graphite is discovered in the iron mass. At higher temperatures the fused iron dissolves more and more carbon, and the cast iron of our blasting furnaces, after having been heated to about 3,000° and slowly cooled down, contains, as known, an abundance of graphite crystals. It was thus natural to see whether a still higher temperature, and cooling under high pressure, might not give the still denser form of carbon—that is, the diamonds.

In order to thoroughly saturate iron with carbon at a high temperature, and to cool it under a high pressure, Moissan resorted to a very simple and effective means. He took a hollow cylinder of soft iron, filled it with some purified sugar charcoal, and corked the cylinder with an iron screw. Then about half a pound of soft iron was molten in a crucible in Moissan's new electric furnace, which readily gives a temperature of about 3,000° C. (5,400° Fahr.), and the cylinder was plunged into the molten metal; iron was thus thoroughly saturated with carbon. The crucible was then taken out of the furnace and plunged into a pail of cold water until the surface of the iron mass was cooled to a dull red temperature, whereupon it was taken out and left to cool in the air. This was the ingenious means of obtaining a high pressure. It is known that water when it becomes ice increases in volume, and that if it freezes in a strong shell the interior pressure of the crystallizing water often bursts the shell; but if it can not burst the shell it necessarily solidifies under an immense pressure, due to the molecular forces. The same was done by Moissan with the liquid iron, which also has the property of increasing in volume while it solidifies. An outer solid crust having been formed by a sudden immersion into cold water, the crust prevents the further expansion of the iron mass, which is thus bound to solidify under an immense pressure, like the water in the shell.

The next step was to separate the iron from the carbon crystals which it might contain. This was done by dissolving the iron in hydrochloric acid, and three different varieties of carbon crystals (which are not attacked by the acid) were received as a residue. Some graphite, some chestnut-colored, curved needles of carbon, and diamond dust could be seen; and they were separated from each other by several complex operations indicated by Berthelot in one of his previous works. A few grains of diamond dust were finally obtained—most of them belonging to the carbonado variety, while a few of them proved to be real diamonds; they were

translucent, they scratched a ruby, and they distinctly showed under the microscope the crystalline structure and cleavage of the diamond; their density was that of the precious gem, and they were completely consumed in oxygen at a temperature of 1,890°.*

Mr. Marsden's experiment with silver was also repeated; but silver being a bad dissolvent for carbon, even at a high temperature, it was boiled for some time with sugar charcoal in the furnace, the cooling being operated in the same way as with iron. The result was extremely interesting. No diamonds were obtained, but a series of carbonados of different densities (from 2·5 to 3·5 times heavier than water) were discovered, some of them in grains, some others in needles, or in conchoidal masses, the densest ones also scratching ruby and burning in oxygen at 1,800°. This is perhaps the most interesting part of Moissan's researches, as it confirms the long-since suspected fact that there is a whole series of carbon molecules each of which is composed of a different number of atoms, and some of which must be very complex.

As to the quantities of diamond dust obtained in this way, they were extremely small. Several cylinders gave no diamonds at all, and from all his experiments Moissan could not collect even a few milligrammes (a few hundredth parts of a grain) of the precious dust, although the black carbonados were quite common. But a sure method is now indicated, and its further development is only a matter of time and perseverance.

The scientific value of these researches is undoubtedly very great. Diamond, like graphite and simple charcoal, is pure carbon, but all attempts at fusing carbon or dissolving it have hitherto failed; it could not be brought into a liquid condition out of which it afterward might crystallize. However, the investigations recently made into the carburization of iron, especially by Roberts Austen, tended to prove that in steel and cast iron the carbon is not simply diffused through the iron, but enters with it into some of those combinations in definite proportions which, like all solutions, occupy an intermediate position between real chemical compounds and purely physical mixtures.† It was reasonable, therefore, to presume that carbon is brought into a liquid condition in molten iron, and that under certain conditions it may crystallize in the shape of diamonds within an iron mass. Moissan's discovery confirms this view. On the other side, the researches of Moissan and Friedel must also throw some light

* From a subsequent communication by Moissan we learn that the same varieties are found in the diamond-bearing earth at the Cape.

† See Recent Science, in Popular Science Monthly, October, 1892.

upon the great questions raised by Mendeléeff as regards the probable presence and prevalence of iron and carbon compounds in the interior of the globe, the formation of naphtha out of these compounds, and other extremely interesting geological questions.*

The artificial reproduction of the diamond must also be viewed as a further step in a long succession of researches which have been lately pursued for artificially reproducing all sorts of minerals, the formation of which had long remained a puzzle for mineralogists. The silicates which were formerly considered as impossible to reproduce in the laboratory have yielded within the last few years before the efforts of the chemists. Sarrasin, Hautefeuille, and especially Friedel, have reproduced different varieties of the chief constituent mineral of our crystalline rocks—feldspar—and the artificial crystals are absolutely identical with those found in Nature. Hornblende, which had long defied the efforts of the explorers, has been finally obtained in 1891 by K. Chrustchoff, after he had spent seven years in unsuccessful attempts;† but in order to reproduce it he had to heat its constituent elements for three months at a temperature of nearly 1,000°. The importance of a high temperature for further achievements was rendered still more evident in Frémy's successful reproduction of the ruby. The ruby is, of course, quite different from the diamond. Like the sapphire and the corundum, it is nothing but alumina—that is, a compound of two atoms of aluminium with three atoms of oxygen, colored by some impurities in red, in blue, or in brown. But for a long time alumina would not crystallize in our laboratories. Later on, Frémy obtained a very fine dust of rubies; but when he submitted the constituent parts of the ruby to a temperature of 2,700°, and maintained the same temperature for one hundred consecutive hours, he was rewarded by full-sized crystals of the precious stone, big enough and in sufficient numbers to have a collar made of them. And, finally, the investigation of Friedel, Le Chatelier, and especially F. Fouqué and Michel Levy, who reproduced a micaceous trachyte containing feldspar, spinel, and mica, demonstrated the necessity of resorting to a high pressure in addition to a high temperature.

To extend the range of high temperatures hitherto obtained, and to devise a means of measuring them, was thus the first condition for further progress in the reproduction of minerals and gems. But the measurement of high temperatures is a very difficult problem which has much occupied of late several prominent physicists and chemists. A thermo-electric thermometer, made of two very resistant metals (platinum and an alloy of platinum

* See, in Mendeléeff's Principles of Chemistry, the footnotes to the chapters on carbon and iron.

† Comptes Rendus, 1891, tome cxii.

with rhodium), and graduated with the aid of the air thermometer, finally came into general use, and it proved to be quite reliable—but only up to 3,000° Fahr.,* which temperature was soon surpassed. Then, Le Chatelier devised a pyrometer based on the variations of intensity of light of fused metals at different temperatures, and this instrument again proved to be sufficiently accurate up to 3,600°; but this last temperature, too, is now surpassed by Moissan, by means of his new electric furnace, which is a real model of efficiency and simplicity.† It consists of two superposed bricks, made of quicklime, or of an especially pure calcinated magnesia. A groove with a small cavity in its middle (large enough to receive a small crucible) is made on the upper face of the lower brick in the sense of its length, and two carbon electrodes are introduced from both sides into the groove. As soon as they are connected with a dynamo machine the electric arc appears between their extremities, and an immensely high temperature is produced in the cavity. Thus, a small Edison machine, worked by a gas engine of eight horse power, gave a temperature estimated at about 4,500° Fahr., and with a fifty-horse-power engine the enormous temperature of about 5,400° (3,000° C.) was reached.

The effects of this little furnace are simply wonderful. At about 4,500° lime, strontia, and magnesia are crystallized in a few minutes. At 5,400° the very substance of the bricks is fused and flows like water. Oxides of various metals which were considered as quite irreducible are deprived of their oxygen in no time; nickel, cobalt, manganese, and chrome oxides can be reduced at a lecture experiment, and a piece of 120 grammes of pure uranium is obtained at once from the uranium oxide. At about 4,050° pure alumina is fused and little rubies are formed; true, they are less beautiful than those of Frémy, but the whole experiment lasts less than a quarter of an hour. At a higher temperature alumina is even volatilized, and nothing is left of it in the crucible. In short, the results are as interesting and as promising as those which Pictet and Dewar have witnessed when they went to the other end of the thermometric scale and produced the extremely low temperatures of about 200° C. below the freezing point.

And, finally, Moissan's discovery establishes a new link between the processes which we obtain in our laboratories and those which are going on in the celestial spaces, in the formation of meteorites. It was known long since that these masses of silicates and nickeled iron which travel in the interplanetary

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* C. Barus in Philosophical Magazine, fifth series, xxxiv, 376; L. Holborn and W. Wien n Wiedemann's Annalen, xlvii, 107.

† Comptes Rendus, December 12, 1892, tome cxv.

spaces and, entering occasionally into the sphere of attraction of the earth, fall upon its surface, sometimes contain charcoal or a special variety of graphite; but later on, in 1887, the St. Petersburg Professors Latchinoff and Eroféeff went a step further and proved that the charcoal is occasionally transformed into diamonds; thus they extracted some diamond dust from the meteorite fallen during the previous year at Novo Urei, in the province of Penza. Some doubts were, however, entertained as regards their discovery, but the fact has been fully confirmed since by Friedel and Le Bel, who found in a meteorite from Cañon Diablo minute diamonds and carbonados exactly similar to those of Moissan.*

It is thus evident that the artificial reproduction of the diamond is not one of those accidental discoveries which may be made without leaving an impression upon science for many years to come. It is only one of the many advances made in a certain direction, and is the outcome of the whole drift of modern research which endeavors immensely to widen the means at our disposal for effecting physical and chemical transformations of matter. It is one step more into a new domain where chemistry, metallurgy, and mineralogy join hands together for revealing by joint efforts the secrets of the constructive forces of matter.

The study of the direct action of environment upon organisms, and of the mechanism of its action, becomes a favorite study among biologists—the "transformists" being no more a few exceptions in science, but already constituting a school which has several brilliant representatives in America, France, and Germany, as well as in this country. It is evident that almost none of the biologists engaged in this kind of research maintains any doubts as to the importance of natural selection as a factor of evolution. To use the words of one of the leading American transformists,† "the law of natural selection is well established, and no more under discussion." For many adaptations it offers the best and the only possible explanation. But biology would have been brought to a standstill if the idea had prevailed that, after a more or less plausible explanation of some adaptation has been given under the hypothesis of natural selection, nothing more is left to be done to explain this same adaptation. For many animals whose manners of life we hardly know at all—the study of animal life having been deplorably neglected for the last fifty years—the explanation would often be little better than a mere hypothesis; but

* Comptes Rendus, December 12, 1892, tome cxv, p. 1039; also February 13, 1893.

† H. F. Osborn, whose admirable essays, mentioned in a previous review, are now published in book form.

even in the best cases the very origin of each variation would still remain to be found. Darwin fully understood this necessity; and the physiological and mechanical origin of variations is what so many biologists are now working at. Several such investigations are already well known to English readers through the works of Cope, Semper, Lloyd Morgan, J. T. Cunningham, and P. Geddes. Many others ought to be analyzed and discussed; but for the time being I can only mention a few recent works relative to the origin of animal colors.

Wherever we go we see animals colored in accordance with their surroundings. White and light gray colors predominate in the arctic regions; tawny and yellow colors in the deserts; gorgeous colors in tropical lands. The striped tiger in the jungle is hardly recognizable among the shadows of the tall grasses. Insects resemble the flowers which they usually visit; caterpillars have the colors and often the forms of the twigs and the leaves they feed upon. Dusty-colored nocturnal insects; moths which take autumnal tints if they begin life in autumn; dark squirrels in the dark larch forests, and red squirrels in the Scotch-fir groves; animals changing their color with the season—all these are familiar instances. But are they all due to natural selection alone? Does not environment take some part in itself producing these colors?

In a very suggestive work*, Alfred Tylor has shown in how far the different markings and the diversified coloration of animals follow the chief lines of structure; and A. R. Wallace has readily admitted that, while the fundamental or ground colors of animals are due to natural selection, the markings are probably due to internal physiological causes.† Coloration responds to function; and there is a law in the distribution of colors and the development of the markings, while there ought to be none under the hypothesis of selected accidental variations. Wallace goes even a step further, and shows that those birds possess the most brilliant colors which have developed frills, chests, and elongated tails, or immense tail-coverts, or immensely expanded wing feathers, all appearing near to where the activities of the most powerful muscle of the body would be at a maximum. He considers "a surplus of vital energy," increased at certain periods, as a *vera causa* for the origin of ornamental appendages of birds and other animals. And it is difficult to examine these and like facts without coming to the same conclusion.

But if partial vigorous coloration is so much dependent upon vital energy, is it not possible to suppose that the decoloration of animals with the approach of the winter is in some way connected

* Coloration in Animals and Plants. London, 1886.

† Darwinism, p. 288 *et seq.*

with a decrease of vital energy, especially if we take into account the permanent white colors of domesticated animals in arctic regions (such as the Yakutsk horse), which can not be dependent upon natural selection? Some recent observations give a certain support to this supposition. Thus we now learn that rabbits which have been taken to the Pic du Midi Observatory (9,500 feet above the sea level) have given in seven years a race somewhat different from their congeners in the surrounding plains. They are a little smaller, have less developed ears, and their fur coats are of a lighter color and very thick. Moreover, the very consistence of their blood has undergone a notable change. It contains more iron, and possesses a greater power of absorption for oxygen.* An anatomical change is thus produced by the environment; and no naturalist will doubt that, if the race continues to multiply for a great number of years in the same conditions, it will maintain its present characters or develop new ones on the same lines, the more rapidly so if natural selection eliminates the less adapted individuals.

A few more additions in the same direction may be found in a valuable work recently published by F. E. Beddard.† Thus, he mentions the researches of Dr. Eisig,‡ who has endeavored to explain the ground colors of some animals as dependent upon their food, and has shown, for instance, that the yellow color of an annelid which is living on a yellow marine sponge (a color which might be explained as protective for the parasite) depends upon the yellow pigment of the sponge absorbed by the annelid. The prevalence of crimson colors among some fishes in a certain part of the New England coast, which is covered with scarlet and crimson seaweeds, is explained by J. Browne Goode by the red pigment derived by the crustaceans from the algæ with which their stomachs are full, the crustaceans being devoured by the fishes. And the experiments of Mr. Guyson relative to the effects of different food plants upon a number of species of moths, as well as those of Mr. J. Tawell upon important modifications produced by food in the larvæ of the large tortoise-shell butterfly, both mentioned in the same work, are attempts in a most important but very young branch of experimental morphology.

Another series of researches is now being made with the view of more deeply penetrating into the physiological causes of animal coloration. Thus, it is a fact well known to fishermen, and now

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* Comptes Rendus, January 2, 1891, tome cxii.

† F. E. Beddard, Animal Coloration; an Account of the Principal Facts and Theories relating to the Colors and Markings of Animals, London, 1892.

‡ Fauna und Flora des Golfes von Neapel: die Capitelliden, quoted by Mr. Beddard, *loc. cit.*, p. 101.

confirmed by direct experiment, namely, by Westhoff, that several fresh-water and marine fishes change their color from white to dark as soon as they have been transferred from a medium with a light-colored bottom to another medium the bottom of which is dark. Fishermen, we are told by Mr. Poulton, even keep their bait in white-colored vessels in order to make it assume a lighter color. The common frog also can change its color to some extent in harmony with its surroundings, while the green tree-frog of southern Europe was long since known for this capacity. It is bright green among green leaves, and dark green when seated on the earth or among brown leaves.* Like changes are also known in the chameleon and in some South American lizards. The causes of these changes have already been investigated by Pouchet in 1848 and Brücke in 1852, but now we have a more elaborate research by Biedermann † upon the same subject. He has discovered three different layers of cells which contribute to give the frog its varying colors. There is first, deeply seated in the skin, a layer of pigment-cells which contain black pigment both in their interior and in their ramified processes, spreading within the skin. These cells are covered by a second layer of "interference-cells" containing bright yellow granules as well as granules of a pigment which sometimes appear blue or purple, and sometimes gray—the whole being covered with a transparent outer skin. The normal green color of the frog is produced by a combination of blue and yellow interference-cells appearing on a black background; but if the black pigment of the deepest layer is protruded into its ramifications, the color of the animal becomes darker; and if it retires deeper, the yellow granules of the middle layer become more apparent, and the frog assumes its lemon-yellow color. Finally, when the yellow pigment gathers into round drops between the bluish interference-cells—not above them—the skin acquires a whitish-gray tint. The same arrangements exist in other reptiles and amphibia.

Now, how is it that the cells change their position in various lights? Is it some reflex action in the nervous system, as it appears in fishes, which cease to change their color when they become blind? Or have we to deal with some direct action of light? Facts are in favor of the second explanation. The slightest change of temperature affects the mutual disposition of the pigment-cells, and consequently the color of the frog; it is enough to keep the animal in the hand to provoke a contraction of its black cells. The amount of blood-supply also has a definite effect;

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* E. B. Poulton, Colors of Animals, London, 1890, p. 82 *et seq.*

† W. Biedermann, Ueber den Farbenwechsel der Frösche, in Pflüger's Archiv für Physiologie, 1892, Bd. li, p. 455.

as soon as a certain part of the skin receives no more blood, the color-cells receive less oxygen, the black cells contract, and the animal assumes a lighter color. But the effects of light are even more interesting. Pouchet had shown that those fishes which usually adapt their color to their dark or light surroundings cease to do so when they have lost sight; they remain dark even in light surroundings.* The indirect effects of light through the intermediary of the visual organs are thus certain. But Steinach† has proved that light acts in a direct way as well—perhaps, we may add, in the same way as it acts upon the chlorophyll grains of the leaves. He glued strips of black paper to the skin of frogs which were kept in the dark, and when these animals were exposed to light, only the open parts of their skin returned to a lighter color, while the covered parts remained dark. To avoid all doubts, the experiments were repeated on skin separated from the body, and photograms of letters and flowers, cut out of black paper and glued to the skin, were reproduced upon it. Besides, blind tree-frogs do not darken as the fishes do, and Biedermann has proved that the chief agency of their changes of color is not in the sensations derived from the eye, but in those derived from the skin. Frogs, whether blind or not, become dark green, or black, if they are kept in a dark vessel in a sparingly lighted room. But when a larger branch with green leaves is introduced into the vessel, they all recover their bright-green color, whether blind or not. In some way unknown, the reflected green light acts either upon the nerves of the skin, or, what seems more probable, if Steinach's experiments are taken into account, directly upon the pigment-cells. Moreover, the sensations derived from the toes have also an influence upon the changes of color. When the bottom of the vessel is covered with felt, or with a thin wire net, the frogs also become black, recovering their green color when a green branch is introduced in the vessel.

We have here temporary changes of color produced by the surroundings; but various gradations may be traced between the temporary and the permanent changes. Thus Lode provoked local contractions of the pigment-cells in fishes by electrical irritations applied locally. And Franz Werner's researches upon the coloring of snakes, recently embodied in a separate work,‡ show that the temporary and irregular spots which appear in fishes and frogs under the influence of artificial irritations are of the same

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* Direct observations have been made also by Alois Lode (Sitzungsberichte of the Vienna Academy, 1890, vol. xcix, 3te Abtheilung).

† Ueber Farbenwechsel bei niederen Wirbelthieren, bedingt durch directe Wirkung des Lichtes auf die Pigmentzellen, Centralblatt für Physiologie, 1891, Bd. v, p. 826.

‡ Franz Werner, Ueber die Zeichnungen der Schlangen, Wien, 1890.

character, and have the same origin, as the also temporary and irregular spots which appear in other fishes, as well as in several tritons and many Gekonides, without the interference of man. Some of the provoked changes of color do not entirely vanish after the irritation is over, and they belong to the same category as the spots which appear in many animals in youth, and disappear with growing age. Moreover, it is maintained that a series of slow gradations may be established between the irregular spots, the spots arranged in rays, and finally the stripes, such as we see them in higher mammals like the zebra or the tiger; and if these generalizations prove to be correct, we shall thus have an unbroken series, from the temporary spots provoked by light or electricity to the permanent markings of animals.*

And, finally, attempts are being made to explain some of the wonderful so-called adaptive colors of insects as a direct product of environment. Some time ago (in 1867) T. W. Wood published experiments upon the larvæ and pupæ of both the small and the large cabbage butterfly. He kept the larvæ during their metamorphoses in boxes lined with paper of different colors, and he found that the colors assumed by the pupæ more or less corresponded to their surroundings. Later on E. B. Poulton made a wider series of analogous experiments, and he saw that the change of color is accomplished during the first hours when the larva spins its web; he came to the conclusion that it depends upon a certain physiological action which is transmitted to the nervous system, not only through the visual organs, but through the whole surface of the skin. These facts have now been fully confirmed again by W. Petersen,† but his explanation is of a more mechanical character. He maintains that the color of the pupa depends upon the pigment contained in both its cuticle and hypodermis. The pigment of the latter is green in the larva, and sometimes it remains green during the pupal stage; but it may be visible or not, according to the amount of dark pigment which is formed in the cuticle, and the amount of this dark pigment entirely depends upon the color of the light. Yellow and orange light prevents the formation of the dark pigment, and in such cases the cuticle, which remains transparent, shows the green pigment of the hypodermis. But the less bright parts of the spectrum have not the same power, and if we trace a curve representing the powers of the various parts of the spectrum for preventing the formation of a dark pigment, the curve has its

* See the polemics engaged upon this subject in Biologisches Centralblatt, December 15, 1890, and July 15, 1891; as also the Zoologische Jahrbücher, 1891.

† Zur Frage der Chromophotographie bei Schmetterlingen, in Sitzungsberichte der Dorpater Naturforscher-Gesellschaft, 1890, vol. x, p. 232.

culminating point in the yellow, and descends toward both ends of the spectrum; it exactly corresponds with the curve of assimilation of carbon by plants under variously colored light. It is also remarkable that the green color of the pupa is only obtained by yellow light, or by such green as contains yellow; such is, as known, the average color of leaves. We thus have a case where environment itself makes the color which approximately matches it.

The meaning of these researches is self-evident. No naturalist will probably attempt to explain the animal colors and markings without the aid of natural selection. But it becomes less and less probable to admit that the animal colors are a result of a selection of *accidental* variations only. The food of the organism, and especially the amount of salt in it, the dryness or moisture of the air, the amount of sunshine, and so on, undoubtedly exercise a direct effect on the color of the skin, on the fur, and on the very intimate anatomical structure of the animal. As to the relative parts which must be attributed in the origin of each separate variation to natural selection on the one side, and to the direct action of environment on the other side, it would simply be unscientific to trench upon such questions in a broadcast way, so long as we are only making our first steps in discriminating the action of the latter agency. The first steps already indicate how complicated such questions are, especially in those cases where natural selection must act in an indirect way—not as a mere selection of already modeled forms, but as a selection of forms best capable to respond to the requirements of new conditions—in which case the intimate organization of the living being comes in the first place. All we may say at the present moment is that the direct modifying action of environment is very great, and that no theory can claim to be scientific unless it takes it into consideration to its full amount.—*Nineteenth Century.*

MR. W. ROE, of the Cape Colony, has pointed out a disadvantage connected with irrigation. Most water used for the purpose contains variable quantities of soluble salts, some of which are not taken up largely by plants. Every application of water, therefore, adds to the saline ingredients of the soil—a very different effect from that of excess of rain water, which, so far as there is open subsoil for it to drain away, would be likely to take out rather than add to the soluble salines in the soil. The mischief of the accumulation of salts in the soil is aggravated in a dry-air land where evaporation is great. The air, acting like a sponge on a surface, takes up the water, leaving the accumulated salts in the surface soil. But this surface soil is as the sponge to the layer beneath. Constantly after each water-leading, the water is drawn to the surface and evaporated, leaving the accumulated salts in the surface soil. The harm done by this accumulated salt will depend on the nature and quantity of the salines in the water used, as also upon the quantity of water supplied.

THE PILGRIM PATH OF CHOLERA.

By ERNEST HART, F. R. C. S.,
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WITH cholera steadily creeping toward our shores, and all Europe standing armed against the invader, it becomes a matter of the extremest interest to inquire how the disease escapes from its home in India, under what influences it becomes able to break its bounds, invade the outer world, and carry death and devastation into countries where not only has it no natural home, but where it is so far an exotic that even after repeated attempts it fails to become acclimatized.

India is the endemic home of cholera, and from some parts of that great country it is seldom entirely absent. In 1881 there were in India 161,000 deaths from cholera; in 1887, 488,000; in 1888, 270,000. The heat, the moisture, the necessity of drinking stored water, and the habits of the people which make that water foul, all combine to plant firmly in the district a contagium like that of cholera. For the living infection, the *contagium vivum* of this disease, enters man's body in the water which he drinks, while in return it enters the water by means of the sick man's discharges. A vicious circle is thus set up. Given a temperature and perhaps a condition of water in which this contagium can retain its vitality outside man's body, and a state of society in which the fouling of the water and the drinking of it when foul are daily habits, and we have before us the essentials necessary to render the disease endemic.

Whether this living contagious matter be a bacillus or a spirochæte is almost beside the present question, and under what circumstances of water and soil it grows and propagates, or merely rests, is again for our present purpose not of much importance. What is certain and what is of extreme importance is that incontestably within the human body it grows enormously; that every individual sufferer from cholera is constantly discharging an untold multitude of contagious particles, which are capable of again setting up the disease afresh in any one by whom they are swallowed; and therefore that if these contagious particles are swept by rain showers into streams or wells, or if the water in which linen soiled by them is washed percolates into tanks or ponds, the water so fouled is specifically poisonous and will produce cholera in those who drink it, just as arsenic mixed in water will produce arsenical poisoning.

It is a matter of surprise to many, who have the proofs of this vicious circle nakedly before them, that the truth so long lay hidden, and that even yet men who have lived much among chol-

era, and who have had large experience of it, should hesitate to admit the fact that the way in which the infection parted with by the one sufferer gets round to another is by the water which the one man fouls and which the other drinks. But, as a fact, those who dwell in the midst of an endemic area, although they may have exceptional opportunities for studying the disease itself, its symptoms, its treatment, and its pathology, are not always so well placed for the investigation of its mode of dissemination as those whose lot is cast in places where the disease is but of exceptional occurrence. In an endemic area the chances of infection are so various and complicated, the difficulty of eliminating other modes of access so enormous, that it is often hard in the extreme to prove the particular route by which the malady has reached its billet. In non-endemic areas, however, things are very different. The disease may not have appeared in the district for months or years; the source of the infection, the first in-carrier of the disease, may usually be known at once, and all his previous doings may be ascertained. With patience every mode of contact or communication between the first and subsequent sufferers may be traced out, free from the interfering influence of possible infection from other sources covert and concealed all around. Thus it happens that much of our most useful knowledge on the subject comes from the investigation of the disease as it has appeared in isolated epidemics rather than in endemic areas.

For Dr. Snow, of London, I must once more claim the great honor of being the first to recognize water as a medium of disseminating cholera. His deductions to this effect, from his observations of cholera in England between 1848 and 1854, were, as I have elsewhere shown, confirmed by the elaborate investigation of Farr and Simon; and in 1866, following in the same footsteps, I placed the corner stone of the edifice by tracing the disastrous cholera epidemic of that year in East London to the distribution of polluted and partially filtered water from the river Lee, by the East London Water Company—the poisonous sewage of one family distributed unfiltered for forty-eight miles. Since that startling experience, I have been convinced that specifically polluted water is not merely an occasional or adjuvant cause, but the *causa causans* of almost every great epidemic of Asiatic cholera.

The earliest important instance in which the agency of water as a disseminator of cholera was clearly demonstrated was that of the Broad Street pump in St. James's, Westminster. The first death in the parish was recorded early in August, 1854, and throughout that month a few deaths occurred each week, but during the week ending September 2d, seventy-eight deaths were registered, in the next week there were two hundred and eighty-

seven deaths, in the following week there were sixty-seven, and then the mortality as quickly subsided as it had arisen. No satisfactory solution of this mysterious outbreak presented itself until Dr. Snow was called in to examine the water supplies. His published report shows the clearly marked incidence of the disease on those who drank from the parish pump. The workers in one particular factory where the water was always used suffered severely from cholera, while those in an adjoining brewery, where the water was never touched, escaped, and numerous instances of fatal attacks of cholera following the use of the treacherously sparkling water from this pump are detailed. On the drains of the house adjoining the well being opened, it was found that there was a cesspool under a common privy, within three feet of the well, and at a higher level than that of the water in it; that the walls of the cesspool being rotten, the contents leaked into the surrounding soil; that the walls of the well were also rotten, and that there was distinct evidence of the cesspool contents having for a long time leaked into the well. Then came the startling fact that in the house itself a child aged five months had died on September 2d, of so-called "diarrhœa," but with distinctly choleraic symptoms.

In 1866 England was again invaded by cholera, and that epidemic is memorable for the terrible experiment which was unconsciously carried out by a water company at the expense of some four thousand lives in East London. Early in the outbreak I was struck by its incidence on the area supplied by the East London Water Company, and I felt confident that it could only be due to a sudden specific pollution of the water supply. Acting on behalf of a great medical journal, I dispatched the late Mr. J. Netten Radcliffe—who had not then become attached to the Medical Department of the Privy Council—to investigate the matter. After much trouble, the result showed that owing to changes having been made in their filtering apparatus, the company had sent out for a few days unfiltered water, or water in a very partially filtered state, direct from the river Lee, which had just at that moment become infected with choleraic discharges from a cottage, the sewers of which were connected with the river, and in which a family had come to reside who had reached Southampton infected with cholera and had been allowed to pass on after they were supposed to have recovered.

These things are now ancient history, and are only here repeated as an illustration of the fact that wherever a single outbreak can be isolated and examined separately, without the intrusion of cases of cholera from round about, the disease is seen to be obviously carried to the patients' mouths by the water which

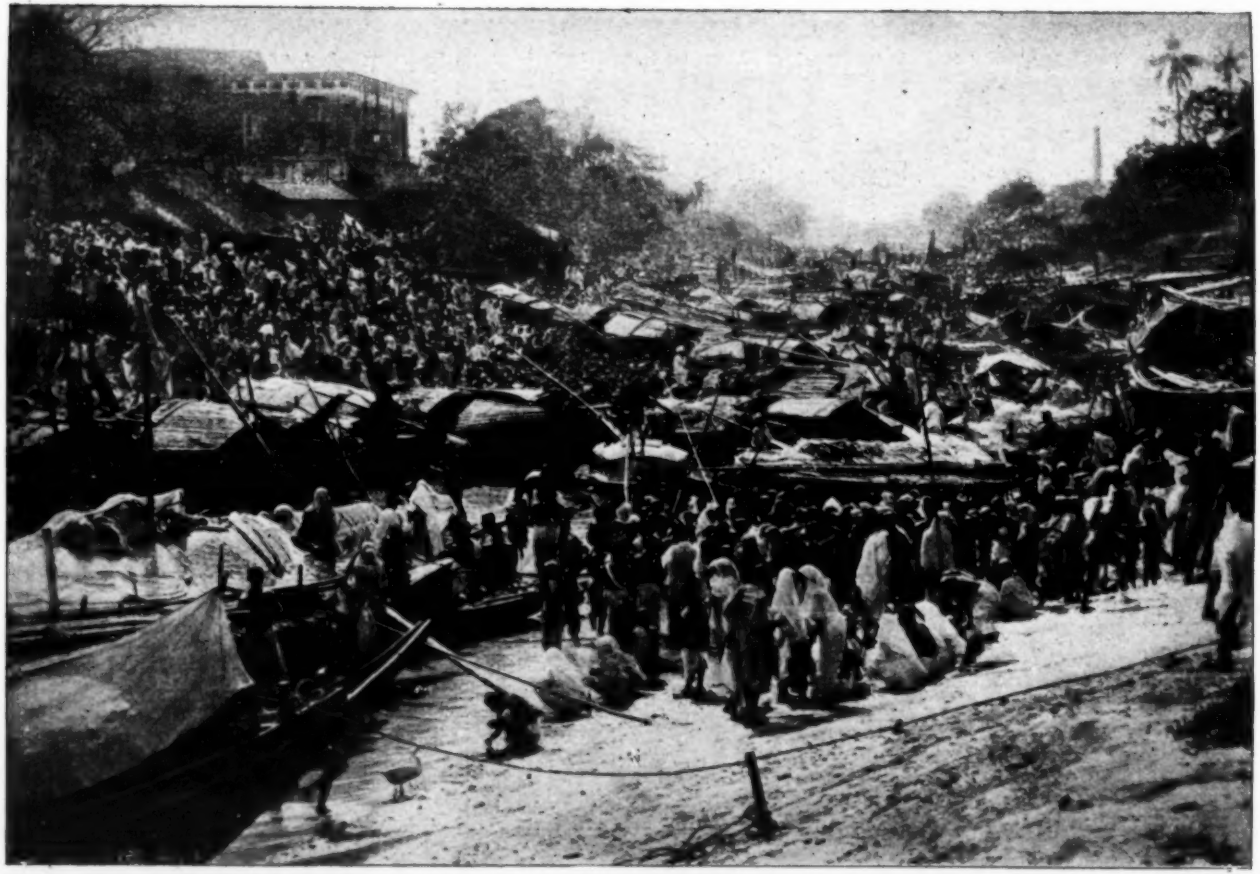

FIG. 1.—VIEW OF TOLLY'S NULLAH AND ONE OF ITS GHATS ON THE MORNING OF FEBRUARY 8, 1891.
The nullah is crowded with boats carrying pilgrims, and with pilgrims bathing in the sacred stream.

they drink. The same was shown in Egypt in 1883, in France in 1884, and again in the department of Finistère almost at the present time.

In Italy, Naples has afforded one of the most striking examples of the same thing. Commencing in August, 1884, the epidemic spread by rapid strides until September 11th, and then rapidly fell. Between August 23d and November 9th some 12,345 cases and 7,086 deaths occurred among a population of 492,908. At that period the water supply of Naples was mainly derived from trenches running from house to house underground, and was exposed to direct contamination not only by soakage of filth, but by the reckless practice of washing in the trenches linen soiled by choleraic discharges.

In the following year Naples was supplied with pure water from a distant mountain stream (the Serino), and there followed a marked immunity of the city from cholera, notwithstanding the presence of the disease in the neighborhood. In 1887, however, an injury to the Serino water conduit led to a temporary return to the old system, and two sharp explosions of cholera at once ensued, but ceased on the resumption of the purer supply. Even more demonstrative was the case of Genoa, a city provided by means of three aqueducts with an excellent supply of a naturally good water. After a few scattered cases a sudden and widespread explosion of cholera occurred between September 21st and 24th, the rich and the poor being indiscriminately attacked. It was soon found that of the first three hundred cases ninety-three per cent were in houses supplied by one of those aqueducts (the Nicolay), and on following that watercourse to its commencement near the village of Busalla, thirteen miles distant, a colony of workmen was found encamped. Cholera had broken out in Busalla on September 14th, and inquiry disclosed the fact that the clothing of the workmen, both of the sick and the healthy, was washed in the river Scrivia, which feeds the Nicolay aqueduct. The supply of this water to Genoa was promptly stopped on September 28th, and the epidemic at once rapidly declined.

Everywhere the same tale is told, but my present immediate object is to insist that also in India, the "home of cholera," it is now clear—to me at least—that water is the agent by which the infection is carried from one human being to another.

The experiences of Calcutta, as observed by Dr. W. J. Simpson, the able health officer of that city, show that those persons who have an abundant and pure water supply—namely, the Europeans and better-class natives—escape cholera epidemics, except in isolated instances which can generally be accounted for; while the natives who depend on tank water suffer severely when a tank becomes polluted by the excreta of a cholera patient.

I think it capable of proof that it is on the scarcity of water, and on the habits and customs which have grown up during centuries of suffering from that scarcity, that the existence even of the "endemic area," the natural "home of cholera," depends. If this be admitted—and I think it can no longer be denied—the fact and necessary inferences from it are of vast and world-wide importance. The natives bathe and wash their utensils and clothes in the tank, because it is the only available place in which to do so, and they use the water of the tank, contaminated as it is in addition by soakage and sewage, for cooking and drinking, because it is the only water supply available for domestic purposes.

With these facts before us, and reading them in the light of our European experience, it can no longer be doubted by thoughtful and reasonable persons that the reason why, in India as in other places, some classes escape and others suffer, is that some drink pure water and others drink water contaminated with choleraic discharges.

Nor can we shut our eyes to the probability, growing stronger every year, that the true meaning of the term "endemic area," in regard to cholera, is a district in which the customs of the people sanction the drinking of fecally polluted water, and in which from temperature, and perhaps from other causes incompletely known, the cholera germ or contagium can easily keep alive and propagate itself in soil or water in the interval between its exit from one host and its entry into another.

Nothing seems more certain than that people can touch cholera patients, and rub them, handle them, and live with them, even in the midst of an endemic area, and not catch the disease so long as they take precautions not to swallow it.

This is the key to the position, the horrid truth, the dirty fact, that the bacillus, the contagium of cholera, lives two lives: one, in the human body, causing the disease, multiplying within the patient, and poured forth by him in abundance; the other, outside the body, waiting in damp ground, on soiled linen, in dirty water —waiting to be swallowed by some one else and to start again on its destructive course. How, then, does it get round? We know well enough that the outside of a cholera patient is not infectious; the infection comes from within, with the discharges; how, then, does it get into the alimentary canal? How can it get round except in what we drink?

This is what I mean by speaking emphatically of cholera being a water-borne disease. It is not that cholera is a disease of rivers and watercourses alone, but that, whether it is a matter of rivers or tanks or water supplies, or merely of wash-basins, jugs, and water-bottles, the water which the patient drinks is the vehicle by which the poison enters, and is the final step in the course of

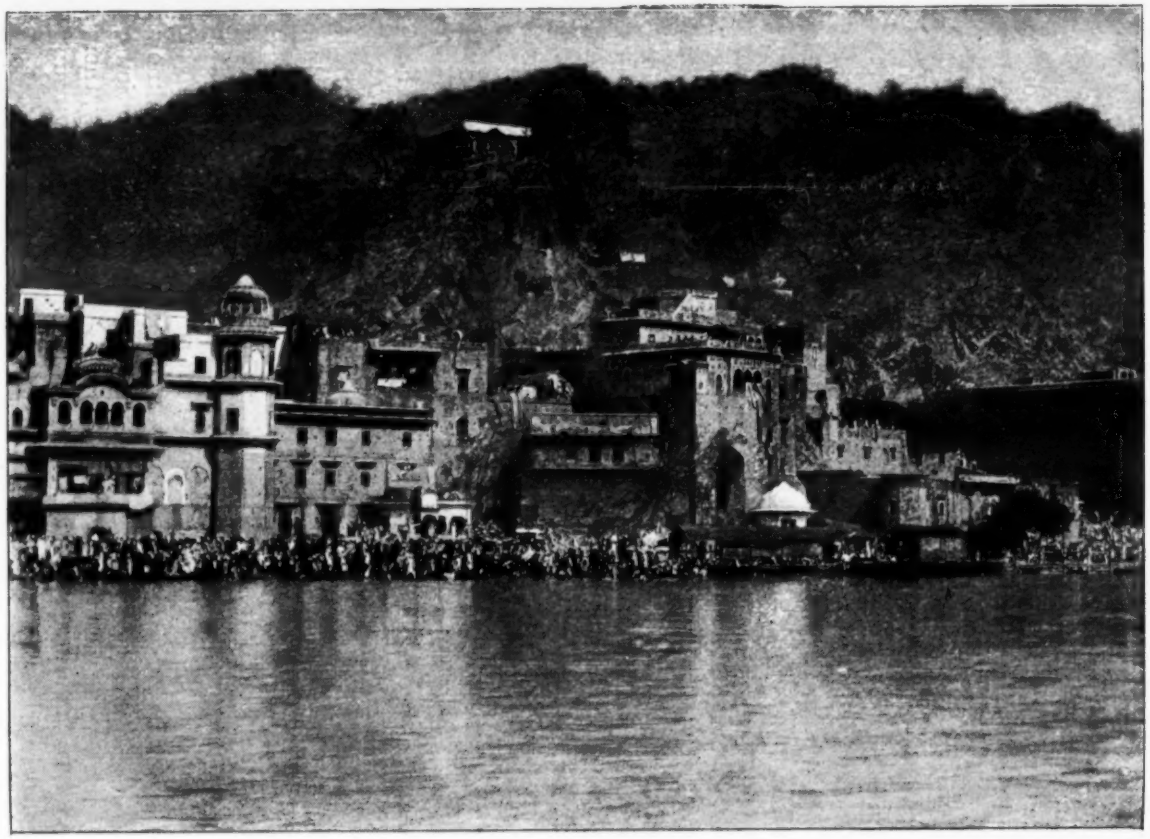

FIG. 2.—SACRED POOL AT HURDWAR.

the infection from its previous breeding ground within the body of a previous patient. We now can understand why, when cholera spreads and breaks its bounds, it follows the lines of human traffic and communication. Man, in fact, is the porter by whom the cholera is carried from place to place, and so the rate of diffusion depends upon the rate of travel. But, as no one porter can carry the malady further than he can go between the time of being infected and being struck down, the wide spread of the disease depends not only on the speed of the porter, but on the sanitary condition and social habits of the place where he is taken ill; for, if these are such that he can transfer his load to others, that the infection he deposits can take root and grow in the bodies of fresh patients, some of whom may travel to fresh places and set up fresh foci of disease, the epidemic spreads; but if, from cleanly habits or clean surroundings, or from plentiful supply of pure water, the infection fails to pass from body to body, the malady dies out, and there is an end of the matter. King Cholera is, in truth, a lazy and voluptuous potentate; unless he is carried by quick steamers, he will not travel far without a rest, and when he reaches his destination he declines either to advance or show his power unless he is nourished and pampered with his beloved luxuries of dirt and filth and fecally contaminated water.

The inhabitants of the Indian "endemic area" are a conservative race—the son lives like the father; one generation passes on like another, and centuries of intermittent pestilence and famine have till lately kept down the population to exactly tally with the means of sustenance. The village community has been for ages the unit which, multiplied by thousands, has made up the population. Each village has mostly kept to itself, and, except for the wars of their rulers, the passage of their traders, and their occasional pilgrimages, they have for time immemorial lived an isolated life. At times of pilgrimage, however, all this isolation is cast aside, and pilgrims from widely scattered districts rub shoulders in the bathing places, wash and cleanse their bodies and their clothes in the same water, which in turn they drink in an unsavory fellowship.

Disease may remain for long tied up in a single village; nay, a whole village may die of cholera, and do but little damage to their neighbors; but in times of pilgrimage cholera travels with the pilgrims, and, after the festival is over, is scattered broadcast through the land. Such fairs as that at Hurdwar, at the junction of the hills and plains, outside the endemic area, but attended largely by those who dwell within, have beyond doubt been the great gateways by which cholera has periodically escaped from its confines to ravage the world at large. Of this the historic

records give abundant evidence, especially in the epidemics of 1867 and 1879.

But, spread all over the country, especially in its northern parts, there is a large Mohammedan population, from among whom there pours out an annual pilgrimage which wends its way to Mecca, the holy place which every faithful Moslem strives to reach—a pilgrimage which of late years has been a recurring danger to the Western world, having been the means of introducing to Egypt in 1866 that outbreak of cholera which carried off sixty thousand of its inhabitants in the course of three months; and of sending on to England the infection, which destroyed six thousand people in London; besides being the origin of the various epidemics which have fallen so heavily on the south of Europe, although they have not done great harm to our own more favored land.

The fairs and pilgrimages of the East constitute the danger of the West, and it is now recognized in every land that this danger is vastly aggravated by the greater rapidity of communication in these latter days. When by weary marches, or sailing in small boats, tacking day after day against opposing winds, months, nay sometimes years, were spent in the journey, those who were taken ill died in the transit; whole caravans melted away, and ships with cholera-stricken crews were lost, together with their crowded cargo of holy pilgrims, and thus the outer world was saved. But with quicker means of communication, with railways and steamboats, and the general hurry of modern life, pilgrims also have quickened their pace, and, what is most important, have lengthened the stages and lightened the labor of their journey, so that the infected ones have lived through hundreds instead of tens of miles before they dropped, and have thus surmounted the barrier of desert and of sea by which Europe was formerly protected. No longer does cholera necessarily sneak round by Russia and the Caucasus, infecting the various resting places on its way, and setting out again as opportunity arises and as caravans and travelers may serve. At one bound it is in Jiddah. Mecca becomes a center of infection, and Red Sea ports distribute the disease to Egypt and the south of Europe.

Ordinary traffic can be watched, and by medical inspection cases of disease can be picked out and isolated; but with a sudden crowding of sixty thousand people devoid of all sanitary knowledge into a country ill equipped with sanitary appliances, governed by rulers whose chief principle and guide is a fatalistic trust in the will of Allah, the problem is complicated in a high degree.

It must not be forgotten that the spread of cholera is not entirely due to the infection carried by those who are attacked. No

man can carry it more than one stage, and whether or not it starts again from the place where he deposits the infection depends on the sanitary conditions of the locality and the customs of the people. There is but little doubt that the danger caused by the Mecca pilgrimage to the health of Europe depends largely on the fact that from the recklessness of the people and the absence of adequate sanitary arrangements in the district, Mecca has become a great central fair for the exchange and distribution of the cholera infection.

In 1886 thirty thousand pilgrims died of cholera at Mecca. Nor can we wonder. Everything seems to be done to destroy their tone and their resisting power; everything seems to be arranged to spread the disease when the infection is once planted amid the host of pilgrims.

From seventy to a hundred thousand seems to be the ordinary average number of those who visit Mecca during the festival, and who are present at Mount Arafat on the 9th of Zu'l Hijjah. They come from every quarter of the compass—inland by caravan from Syria and Persia, Turkey and Afghanistan; by sea from Red Sea ports; from Africa, across the whole width of which many of the weary pilgrims have walked; and from every part of the world where the standard of Islam has been raised. With no provision for decency or comfort they camp around or crowd into lodgings in the sacred city. They make excursions, clamber up the mountains, spend hours in the blazing sun, are sickened with rotting smells arising from the thousands of animals which are sacrificed; crush and stifle in the Ka'ba; and, finally, as if they had not already run sufficient risk of catching every possible complaint, they drink the water of Zem Zem. This is the well from which Hagar is said to have drawn water for her son Ishmael, and the drinking of the water is a most holy rite. The supply, however, is not as great as could be desired for so large a crowd of pilgrims, and the manner of dealing with it at the well goes far to explain the intensity of the poison and the fearful mortality which attends any outbreak of cholera among the Meccan pilgrims. At a given period the pilgrims stand naked in turn at the place appointed; a bucket of water is poured over each man; he drinks what he can of it, and the rest falls back into the holy well. The water from this well has been analyzed by Dr. Frankland, F. R. S., of the Royal College of Science, London, who describes it as fearfully polluted with abominable contaminations. Imagine, then, one single member of this enormous crowd to be suffering from the early stage of cholera; to be struggling, as struggle he would with his last strength, to get through the holy rite, and to be allowing the choleraic discharges with which his body would be soiled to be washed back into this foul well.

Fig. 3.—Approach to the Sacred Pool of Hurdwar, with Pilgrims bathing.

What is to happen to the crowd of pilgrims who close in on the spot that he has left, and who, each in turn, swallow in rapt fervor the fetid draught in which these thousands have been washed? Can we wonder, then, knowing the history of the Broad Street pump, that in 1866, within a few days of the ceremony, the road leading from Mecca was for twelve miles thickly strewn with dead bodies—a holocaust to be added to the account of perverted religious rites which has already so deadly a record?

Gradually England is undertaking the gigantic task of not only ruling India—a thing to which India has been accustomed for untold centuries—but of reforming and remodeling her habits and her customs, a thing hitherto quite unknown, untried, and thought by many to be impossible. A stolid mass of conservatism of habit and even of thought has to be moved, and has to be so moved as not to drift into anarchy and reaction. This is a long, slow, tedious process. The existence of the "endemic area," the "home of cholera," depends largely on the persistence of habits and modes of life which can hardly be rooted out. If they are to cease, they must probably die away or be slowly crushed out rather than be swiftly overturned. We may at once make up our minds that if the safety of Europe can only be attained by abolishing cholera in India, Europe will for long remain in danger. It is hard to say how long: the object of this essay is to abridge the period to the utmost. To those, again, who know best the condition of the towns in the south of Europe it seems an almost equally far-off hope to expect them within any reasonable time to reach such a condition of cleanliness and sanitary preparedness as to be able to look calmly on the approach of the dread disease. But this is a much less formidable and more hopeful task, when once it is courageously and persistently faced. Are we meantime to stand helpless? Can nothing be done to stop the infection on the way? Not so. In the matter of ordinary travelers isolation of the infected need not be insuperably difficult. The individual attacked may be sent to a properly equipped hospital, be surrounded by a true *cordon sanitaire* in the modern sense—not a ring of gendarmes or a circle of quarantine as of old, but *an area of sanitation*, within which cholera can not spread. Within this area the disease may expend its force with injury to no one and the crisis pass without danger to the country. But the case of the pilgrims is different. Fairs and pilgrimages of India differ from other means of spreading the disease in this, that not only do they draw people from all parts and thus increase the chances of receiving the infection, but the people attend them in such numbers that they support each other in carrying on their own customs, the very customs which have for centuries conduced to the spread of the disease in cholera's home. It is as if the fair or

the pilgrimage were not only supplied with a proper dose of the infection, but were provided with a plot of the "endemic area" on which it could be grown. In bedding out a plant we do not put its naked roots into the new inhospitable soil, but we place in the new ground a portion of the mold in which it hitherto has grown, so that its tender rootlets may gradually get accustomed to their new surroundings. And the fairs and pilgrimages of India do much the same to plant the cholera in the new localities. The infection carried from the endemic area can not die out, even although it be but an exotic in a strange land, because the people carry with them also the habits and customs which are conducive to its growth, the willingness to use the same water for every purpose, the readiness to drink it when in its foulest state.

In a report in June, 1891, Dr. W. J. Simpson, of Calcutta, gave a picturesque and startling account of two large pilgrimages which he personally witnessed in that year—one in the endemic area of Bengal, and another in the non-endemic area, or north part of India. A pictorial presentation of one of their chief features, which I am able to give from private photographic plates that he has furnished me, will show the condition more effectively than merely verbal discussion.

The first of these was the Ardhodoya Jog, which comes round at rare intervals, happening only when the moon is in conjunction with the sun in a certain latitude of the Indian zodiac. This event, it appears, only occurs once in twenty-seven or twenty-eight years, and is then made the occasion for a great bathing festival. The purity to be obtained by bathing in the Ganges during this festival is exceptionally great, and therefore the gathering of pilgrims at the several bathing grounds was a very large one.

Kalighat, where the gathering in question took place, is the suburban area of Calcutta, on Tolly's Nullah, a small tidal creek which is held to be more sacred than the Hooghly, because it is believed to be one of the original beds of the Ganges which has gradually silted up. Sanctity, however, in these parts is no assurance of decency. Along its banks on both sides houses and huts are built, the drainage from the latrines of which finds an easy and convenient outlet into the streamlet. Soiled clothes of the sick and healthy are washed here; oxen, buffaloes, horses, goats, and other animals take their bath in the water; and as the nullah has frequently passing through it many country boats, the boatmen add to the general pollution.

Kalighat, like the other suburbs of Calcutta, also possesses a large number of tanks or ponds, round which the huts or houses of the inhabitants are built, and which are the drainage cesspools of the locality. Much has been said concerning the filthiness of

these tanks. Their contents more or less resemble pea-soup in color, and their composition has been officially reported as similar to concentrated London sewage. Those conversant with the uses to which these tanks are put will not be surprised at this statement. And yet these ponds of filth are constantly resorted to for the cleansing of utensils and the soaking, maceration, and washing of the rice and *dahl*, and in the preparation of sweetmeats.

The nullah can be waded across at low tide, but it is the receptacle of unspeakable filth of all kinds. After describing the insanitary arrangements of the neighborhood, Dr. Simpson remarks that "without a good water supply, or drainage, or proper means of disposal of the excreta and sulliage, with crowding together of huts and houses irregularly placed, and with the filthy tidal nullah, which is practically the sewer of the district, and with numerous polluted tanks, Kalighat, it may be surmised, is at no time a healthy spot, and at all times a danger to pilgrims." On the occasion in question at least 150,000 people came into Calcutta in the first and second weeks in February. Great throngs came on foot whose numbers were not noted, 25,000 came by boat up the nullah, 90,000 came by the Eastern Bengal State Railway, and 32,000 by the East Indian Railway. Obviously the influence of railways in intensifying the danger of quick and wide diffusion of cholera after great festivals must not be neglected.

To describe the crowding which occurred in the nullah on the festival day is difficult. Perhaps the accompanying photographs will give some idea of the scene, and of the recklessness with which the filthy water was being bathed in and splashed over the head and even drunk. A large proportion of the pilgrims would not drink filtered water. They had come, they said, to bathe in and drink Ganges water, and they would have none from the stand-posts or the carts. Happily, the tube-well near the police station was not considered unholy, and was in lively requisition. The picture shows the crush to be very great, and it is marvelous that no accidents happened.

Among the large number assembled there it was not likely that cholera would be entirely absent, and if present it was certain to be spread by the customs of the festival, and thus it happened that in the second week in February nearly two hundred of the pilgrims died from cholera. The pilgrims soon had to be dispersed, and though their dispersal checked a larger outbreak at Kalighat, which would only have widened its circle afterward, it could not prevent those already infected from suffering on their way home. Consequently, at some of the railway stations sick people had to be taken out of the trains; passengers by boat died on their voyage, their bodies being thrown overboard; while travelers on foot were picked up dying or dead on the roads.

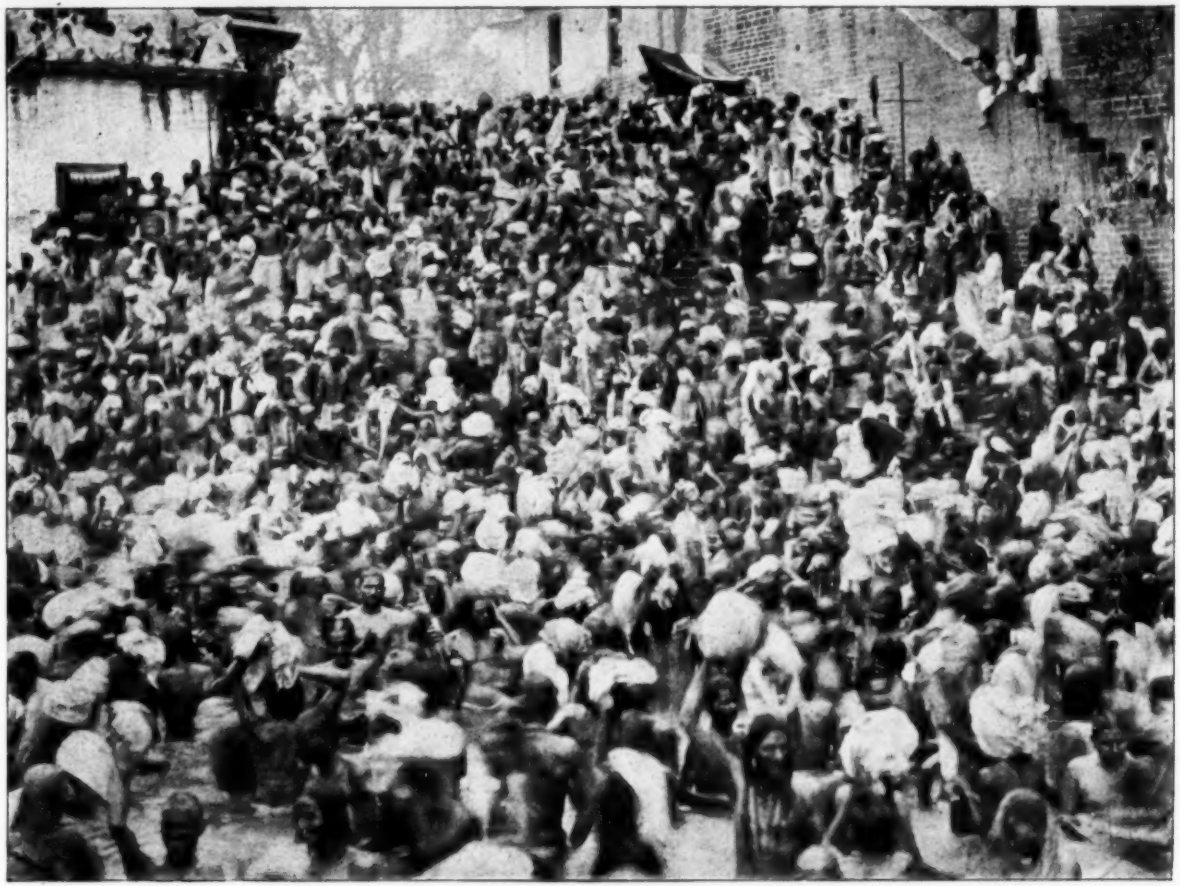

FIG. 4.—PILGRIMS SWARMING AROUND THE SACRED POOL AT HURDWAR.

To the pilgrims themselves the festival turned out a disastrous affair, but later investigation showed that in many villages to which they returned the residents also were affected, and that in at least three districts widespread epidemics were set up.

Such is a pilgrimage within the "endemic area," where perhaps it may be said that the danger in regard to cholera may be measured by the deaths, the dissemination of the infection through a population already charged with it not being of great importance.

But any Indian pilgrimage, even in a non-endemic area, has much the same characteristics. Dr. Simpson's description of the great Kumbh festival, which occurs once in twelve years at Hurdwar, outside the endemic area, is also very graphic, and the photographs (Figs. 2, 3, and 4) show the sacred pool and the approaches to it to be hidden by a mass of semi-naked human beings. The pollutions to which the sacred pool is exposed on these occasions are indescribable. There are not only the washing of the sacred fakirs, who cover themselves with wood ashes as their only clothing, and the general bathing of the pilgrims, who are not all in the cleanest of clothes—several, moreover, on the occasion in question being seen bathing with skin diseases upon them—but the ashes of deceased relatives brought from the different homes of the pilgrims, and the hair of widows who have been shorn, are also thrown into the water. The stream, usually so bright and pure, soon became a muddy one, offensive to the senses, and, although outside the endemic area, bacteriological examination of this defiled water showed it to contain the comma bacillus, which is looked upon as the true contagium of cholera.

With these pictures in our minds of what an Eastern pilgrimage means, and of what is done at the great festivals, whether of Hinduism or Mohammedanism, can we wonder that they are so constantly the means of lifting cholera out of its ordinary endemic character and spreading it over the world at large? In old times when cholera marched overland its route could almost be dotted out by the fairs which it infected. Now, with more rapid means of communication, Mecca, with of course Jiddah its port, is the half-way house, the halting place, the one spot at which it must be caught and stopped if Europe is to be protected. Hither tend pilgrims from all parts, including those from the infected area; here are performed rites which involve of necessity the wide spread of the infection among the visitors, if even perchance but one of them bring with him the disease; hence in a fortnight's time is scattered this great host, carrying with them the germs of pestilence to their homes in distant lands. Mecca is a peril to Europe, and at all cost Mecca must be made a sanitary area, in which cholera if it should arrive can play itself out, and from

which no infection shall be allowed to be exported. It is, however, idle to expect a Government such as that of Turkey spontaneously to undertake the task. The affair is too expensive to be undertaken by a ruler to whom ready cash is worth more than prospective suffering. Nor would his people support him in such a crusade. To them Allah is great, and cholera is his will; nor perhaps does the evil seem to them so grievous as it does to us. To those who have to suffer Turkish rule a little cholera now and then may seem but a flea-bite.

It seems probable that no single nation can effectually interfere, although if any one nation could do so, it would be England or Russia. The danger belongs, however, to Europe; and if anything is to be done, Europe collectively should take action without delay, with the aim to cleanse the ports of the Red Sea, reorganize Mecca and its greedy crew, and supervise the pilgrims in all their course.* With the increasing care, and the increasing intelligence with which that care is being exercised, in regard to cholera in Europe, and with the facilities given by the telegraph for watching the progress of cholera when it approaches *via* Russia, and the growing willingness shown by that great state to block the way when it invades her vast dominions, the Red Sea remains the route from which Europe and America have most to fear, and Mecca with its insanitary surroundings, its filthy rites, its crowds of devotees, stands as the half-way house between Europe and the home of cholera. Can we not for once think of the good of man rather than of nations? With railways and steamers linking us so closely in one family, we can no longer afford to fold our arms and look with indifference even at the strange

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* There are many indications that such representations, made in a suitable manner and by authoritative personages to the Sultan, would be warmly backed up, not only by his own personal feelings and sentiments, but also by those of an enlightened and considerable portion of his subjects. The Scotsman of January 6th says: "Queen Victoria having the largest number of Mussulman subjects, the Government of Bombay was some years ago moved by the hardships and mortality to which so many of them were exposed on the pilgrim voyage to Mecca every year. A contract was accordingly made with Messrs. T. Cook and Sons, under which the Hajjees are conveyed to and from the Red Sea ports in safety and comfort. But that avails little if they are to perish from the filth of Mecca itself, and take from it those cholera germs which they spread all over eastern Europe and Asia." Encouraged by an article on the subject in the Nineteenth Century, written by Mr. Ernest Hart, the Mohammedans of Madura, near Cape Comorin, have held a public meeting and memorialized his Imperial Majesty the Sultan of Turkey "to adopt suitable measures for improving the sanitation of Mecca and other places of pilgrimage." They make the sensible suggestion that every year during the Hajj the leading Hajjees from every country should meet and draw up a report on the state of the city and shrine to the Sultan and ask for the needed reforms. If the Sultan were not afraid of another war with the Shereef, who is the real master of Mecca, he would insist on such a share of the pilgrim fees and offerings as would make Mecca the healthiest place in his dominions.

doings of poor fanatics of Mecca. Such is the solidarity of the modern world that at the present moment it is the doings of these people, who seem so far away (geographically thousands of miles, socially and as regards their sympathies and interests quite in another sphere), which threaten us now with a repetition of such epidemics as that which not so many years ago carried off one in every forty-seven residents in Whitechapel, one in fifty-seven in Ratcliffe, one in sixty-seven in Rotherhithe, and which only last year killed off people in Hamburg at the rate of two hundred to three hundred per day for weeks together.

This is no fanciful speculation, applicable only to days gone by. Last month five thousand pilgrims died in Mecca; their infected and scattered companions are reaching Jiddah and El Tor, and are spreading over the world to their various homes. To them we may look with fear and doubt for the probable initiation of an epidemic in Europe, to follow close upon the footsteps of that which is now at our doors.

GRANDFATHER THUNDER.

By ABBY L. ALGER.

DURING the summer of 1892, at York Harbor, Me., I was in daily communication with a party of Penobscot Indians from Oldtown, among whom were an old man and woman, from whom I got many curious legends. The day after a terrible thunderstorm I asked the old woman how they had weathered the storm. She looked searchingly at me and said, "It was good." After a moment she added, "You know the thunder is our grandfather?" I answered that I did not know it, and was startled when she continued: "Yes, when we hear the first roll of the thunder, especially the first thunder in the spring, we always go out into the open air, build a fire, put a little tobacco on it, and give grandfather a smoke. Ever since I can remember, my father and my grandfather did this, and I shall always do it as long as I live. I'll tell you the story of it and why we do so.

"Long time ago there were two Indian families living in a very lonely place. This was before there were any white people in the land. They lived far apart. Each family had a daughter, and these girls were great friends. One sultry afternoon in the late spring, one of them told her mother she wanted to go to see her friend. The mother said: 'No, it is not right for you to go alone, such a handsome girl as you; you must wait till your father or your brother are here to go with you.' But the girl insisted, and at last her mother yielded and let her go. She had

not gone far when she met a tall, handsome young man, who spoke to her. He joined her, and his words were so sweet that she noticed nothing and knew not which way she went until at last she looked up and found herself in a strange place where she had never been before. In front of her was a great hole in the face of a rock. The young man told her that this was his home, and invited her to enter. She refused, but he urged until she said that if he would go first she would follow after. He entered, but when she looked after him she saw that he was changed to a fearful *wee-will-mecq*—a loathly worm. She shrieked and turned to run away, but at that instant a loud clap of thunder was heard, and she knew no more until she opened her eyes in a vast room, where sat an old man watching her. When he saw that she had awaked, he said, 'I am your grandfather Thunder, and I have saved you.' Leading her to the door, he showed her the *wee-will-mecq* dead as a log, and chopped into small bits like kindling wood. The old man had three sons, one named 'M'dessun.' He is the baby, and is very fierce and cruel. It is he who slays men and beasts and destroys property. The other two are kind and gentle; they cool the hot air, revive the parched fields and the crops, and destroy only that which is harmful to the earth. When you hear low, distant mutterings, that is the old man. He told the girl that as often as spring returned she must think of him, and show that she was grateful by giving him a little smoke. He then took leave of her and sent her home, where her family had mourned her as one dead. Since then no Indian has ever feared thunder." I said, "But how about the lightning?" "Oh," said the old woman, "lightning is grandfather's wife."

Later in the summer, at Jackson in the White Mountains, I met Louis Mitchell, for many years the Indian member of the Maine Legislature, a Passamaquoddy, and asked him about this story. He said it was perfectly true, although the custom was now falling into disuse; only the old people kept it up. The tobacco is cast upon the fire in a ring, and draws the electricity, which plays above it in a beautiful blue circle of flickering flames. He added that it is a well-known fact that no Indian and no Indian property were ever injured by lightning.

THE Council of the Royal Agricultural Society of England has instituted a fund to be contributed by all interested in agriculture, for preparing a testimonial to the invaluable services rendered to that art by Sir John Lawes and Dr. Gilbert. Subscriptions are to be limited to two guineas. The testimonial will take the form of a granite memorial, with a suitable inscription, to be erected at the head of the field where the experiments were made; and an address to Sir John Lawes and Dr. Gilbert, accompanied (if the funds permit) by a commemorative piece of plate.

SCIENTIFIC COOKING.

A PLEA FOR EDUCATION IN HOUSEHOLD AFFAIRS.

By Miss M. A. BOLAND,
INSTRUCTOR IN COOKING IN THE JOHNS HOPKINS TRAINING SCHOOL FOR NURSES.

THE general interpretation of the colloquial use of the word scientific as applied to cooking is that manner of making dishes which is carried out according to some exact method, which has been proved by experiment to be correct or satisfactory. This is well as far as it goes; but scientific cooking, in order to justly merit the name, should also include: 1. A knowledge of the chemical composition of food materials and food, that a woman may know when she is supplying her family with a diet composed of all those principles, in correct proportion, which are necessary to perfectly nourish the body, and also that she may appreciate that she is not always obliged to buy expensive materials in order to obtain that which is needful and wholesome. 2. A knowledge of the methods of preparing and preserving food, both cooked and uncooked, under such conditions of cleanliness that it shall be free from poisonous or noxious principles. 3. A knowledge of the laws of health, that it may be possible in some measure to determine what constituents and what eatables afford proper material for the maintenance of the body, and under what circumstances of occupation, exercise, and living in general they are most completely utilized.

Upon the subject of the composition of foods there is abundance of valuable literature in English from which much can be learned. Since the days of Baron von Liebig and Count Rumford, who may be said to be the promoters of the "cooking movement," a great deal of scientific investigation as to the chemical composition, nutritive value, and methods of cooking food has been done, and out of this study, in connection with medical research, has sprung the modern school of hygiene, as yet, however, in its infancy. In the works of Parkes, Pavy, Atwater, Foster, Smith, Blythe, and Hassal most valuable information on this subject may be found.

A well-grounded knowledge of the chemistry and physiology of foods is the foundation upon which all good work in cooking must be laid. Through it only can be known and appreciated the reasons which underlie the various processes of preparing food, which, once well understood, form the sure foundation upon which all conscientious and worthy effort should rest. Such knowledge embodies the principles of the subject, and without principles no work can possess lasting educational value.

The second suggestion, methods of preparing and preserving food so that it shall be free from poisonous and harmful substances, indicates the necessity for some knowledge of bacteriology. The various fermentative and putrefactive changes which take place in food substances are caused principally by the growth in them of microscopic forms of plant life known by the general name of micro-organisms.

When micro-organisms grow in masses, as may be seen in the green and yellow molds of bread and cake, they are plainly visible to the naked eye, but to distinguish individuals a microscope of high magnifying power is necessary. The common mildew, the decay of apples, melons, and other fruits, the rot of vegetables, and the decomposition of eggs and meat are due to the transforming power of these invisible agents. One of the most common and best known is yeast, which has been more studied and is probably better understood than any of the ferments. It is frequently mentioned to illustrate the transforming power of these infinitely tiny forms of life. A bit of yeast is like a little mass of seeds, each a single cell; these, when they are placed in a proper medium—in other words, find the surroundings of food, moisture, and warmth necessary for their life—multiply with extraordinary rapidity, using what they require of the food in which they find themselves, decomposing sugar and starch and establishing changes which result in carbonic acid and alcohol as the chief products. We take advantage of the production of carbonic acid by yeast to make our loaves of light and wholesome bread.

Micro-organisms are everywhere: they exist in the earth and the sea; in plants and animals; on the surface of our bodies and in the digestive canal; in cooked and uncooked food; in refuse, particularly animal waste; on our clothing, books, furniture, and in the dust of the atmosphere. Wherever they find suitable food, warmth, and moisture they increase with wonderful rapidity, and, if undisturbed would in time completely transform the object upon which they fall. However, by removing any one of the factors necessary to their growth, they cease to multiply, and under such conditions some species remain inert, some die.

Like other forms of life, micro-organisms by their growth give rise to various products which may be either harmless or harmful. Of the latter may be mentioned noxious gases which pollute the air and poisonous substances which render our food unwholesome. The souring of milk, and the putrefactive changes which, in the presence of heat, so rapidly set in in eggs, meat, oysters, lobsters, crabs, and other albumen-containing foods, are among the results of their transforming power. Perhaps the most important point for us to consider here is, that it is highly

probable that these substances just mentioned and others of similar nature often, when apparently good, contain poisonous matter in small quantities, which produces in human beings, when those foods are eaten, grave digestive disturbances. Should the eating of such food be continued for a length of time, or the amount of poisonous matter be large, serious results of illness, or even death, may follow. Instances are on record of fatal cases of poisoning caused by eating oysters too long out of the shell, lobsters not fresh, and other easily putrescible substances.

The object of the bacteriological study of food is not alone to prevent the use of actually poisonous materials, but also to prevent the use of those which are not absolutely good.

Perfect digestion, perfect assimilation, and as a consequence healthful blood can not result from the use of questionable food. If we attempt to consider what constitutes a healthy condition of body we find a very complex subject before us: constitutional peculiarities, manner of dress, surroundings, air, occupation, climate, etc., as well as food, all influence physical development. We find the answer involves too many points to be given simply and directly, but one very essential thing to do certainly lies in the direction of food. The nutritive material for replenishing the blood is made from the food we eat and the air we breathe; it, therefore, is entirely reasonable to claim that the condition of the air breathed and the preparation of the food eaten are of great importance.

Food should be wholesome in itself, prepared in exquisitely clean surroundings by neat hands, and cooked with intelligence. Food prepared by slovenly cooks in slovenly places not only is not æsthetically acceptable, but is neither palatable nor wholesome, and often contains ptomaines, toxines,* or other poisonous matter the results of changes of a dangerous character, or it may be contaminated with the bacteria of disease. When we know that micro-organisms are the primary cause of many kinds of fermentation, that all forms of food are excellent material for them upon which to thrive, that instances are on record in which poisons have been isolated from food which has caused sickness, it may be repeated that it is entirely possible that food kept in questionable places and prepared in an uncleanly manner does often contain that which is positively injurious to health.

It is evident that one of the first considerations of a thoughtful and intelligent housekeeper toward securing one condition at least of good health should be absolute cleanliness in all things—

* Ptomaines are certain crystallizable substances formed by the growth of bacteria. They are often but not always poisonous. Toxines are substances also produced by the growth of bacteria, but of a different nature from ptomaines; they are always poisonous.

that cleanliness which excludes as much as possible all kinds of extraneous ferments from food and its surroundings. We know that micro-organisms are the agents of fermentation; we know the factors necessary to their life, namely, food, warmth, and moisture; deprived of any one of these, their growth is stopped and they become inert, or die. To illustrate, a piece of meat deprived of moisture—that is, dried—is proof against the growth of organisms upon it so long as it remains dry, and it "keeps," as we say—that is, it does not decay; or, it may be hung in an ice-box or frozen as in winter—that is, deprived of warmth—with the same result. It, then, is a possibility to control the multiplication of these forms of life when we understand their modes of existence.

Scientific cooking should include not only the proper construction, so to speak, of eatables, but a knowledge of their constituents both inherent and extraneous, and some understanding of the physical life of human beings. Heretofore, cooking has been done for the most part upon what might be called "haphazard" lines, without any special degree of exactness and with but little actual information as to the nutritive value of the substances dealt with, or of the processes which would render them most palatable and digestible. This manner of conducting the cooking of a home gives mainly two results: (1) a great deal of wretched food, which directly or indirectly affects the health of the family, and (2) an enormous amount of unnecessary waste. The primary consideration is, of course, the one of health. When we recollect that hygienists and medical men hold the opinion that disease does not find lodgment in a sound body, that to be perfectly healthy means no sickness, except from accidents and natural causes, is it not enough to inspire all women to study and master the means which conduce to health and the laws which govern healthy conditions? This point may be illustrated by the fact that pneumonia does not attack healthy persons. Children, the old or enfeebled, and those who are debilitated, are its victims. Pneumonia is a bacterial disease, the germ of which is present in the mouths of about one fifth of all well persons. Exposure to cold, the prolonged use of poor food, or excessive fatigue, any of these may lower the tone of the system to such an extent that its cells and fluids, being out of their normal condition, can no longer resist or overpower the germ of the disease, which, finding lodgment in the tissues of the lungs, produces the malady known as pneumonia. It is on this point, that the cells and fluids of a *perfectly healthy* body have the power to protect the inner organs from the invasion of bacteria and bacterial products, that we base our strongest argument for more healthful ways of living.

The greatest necessity of life is air, which is supplied to us pure (outside of large cities), without the necessity of effort on

our part to procure it. We have only not to interfere with what Nature has given by inclosing it in rooms, or by allowing it to be contaminated with noxious gases or other impurities. The second greatest necessity of life is food, which includes water. Food is the raw material of the body from which it constructs its tissues and repairs them as they wear. It furnishes the elements from which are evolved the forces of the body, such as heat, muscular and nervous energy and other powers; of these, heat is the most important, it being ever required that the constant temperature which the body must always possess to be in a state of health may be maintained. Food also furnishes material for a supply which is stored away in the body for use in emergencies when from accident or other cause nutriment is cut off.

Food is to the body what fuel is to the fire. It and the oxygen of the air are the agents which maintain the life of the system. What can be more worthy our attention than so important a subject?

We all know that some kinds of food are more easily digested than others, and we also know that the same kind of food treated in cooking by different methods varies in digestibility, according to those methods. To illustrate, an egg cooked in such a way that its albumen is coagulated, but tender and jelly-like, not hardened, is a very easily digested food substance; while an egg cooked at a temperature so high that its albumen is rendered tough and tenacious is very difficult of digestion, and it is known that well persons have been made temporarily ill by eating eggs so cooked.

What is true of the egg simply illustrates what is true of nearly all food substances—that is, that the temperature at which they are cooked and the manner in which they treated, as to the time of exposure to heat and their combination with other things, makes all the difference in their digestibility and flavor. This constitutes our second argument for the study of cooking.

If only because we have at best but glimmerings of the complex, intricate, and mysterious processes of the life of the physical human body, should we strive to maintain it in most perfect condition, and endeavor in the clearest lights of modern science to make it indeed a temple for the indwelling of the mind.

It is thought by some students of the subject that crime is a disease; that had the men, who are to-day criminals, been reared under better conditions, of both nourishment for the body and influence for the mind, they might have been worthy, even noble citizens.

Missionaries, both at home and abroad, are beginning to realize that it is of little use to pray with a man until they have fed him. In fact, the first work of the missionary of to-day is to provide

the object of his thought with necessary food, clothing, and shelter, and care and relief in sickness. When these are adequate, and not before, is the exercise of the "so-called" religious influences of any avail. This, of course, is nothing more than practical common sense. A man reduced by lack of proper and sufficient nourishment, and surrounded by all the depressing influences of poverty, can not do wise thinking. There is not in his body the blood to send to the brain for use. Where there is no fuel there can be no fire.

It is safe to say, as a general rule, that when a man is well nourished his natural leaning is toward industry. He *must* have something to do. When a man is healthy and industrious he is a safe citizen. Health and industry united often point the way to ambition, and ambition directed in the right path may lead into vast regions of power and influence.*

No richer endowment can be bestowed upon one than a healthy and vigorous physical constitution. The possibility of starting man on the journey of life so equipped rests largely with women. The care of little children falls entirely to them during the time when they most need the greatest amount of wise and intelligent attention in order that they may be started in life with a sound body, which shall be the temple for the sound mind which is to be developed and cultivated later. Specialists of children's diseases claim that the manner in which a child is fed and cared for during the first five years of life determines what he shall be ever after.

I listened last winter to a series of lectures on insanity by a specialist of the subject. In speaking of the different forms of the disease, hallucination, melancholia, acute mania, etc., he said that those forms of disease almost always begin with the inability of the individual to digest food well. He does not eat well, does not sleep well, and after a time becomes what is called "nervous," which is usually nothing more than a malnourished condition of the nervous system; then he drifts into melancholia and finally insanity.

The treatment by Weir Mitchell the noted specialist of such diseases, is what might vulgarly but graphically be called *stuffing*. His patients are put to bed under the pleasantest and most comfortable conditions of absolute rest and freedom from responsibility, and then they are fed with as much nutritious and wholesome food as they can be made to eat. The results of this treatment have been most gratifying.

What woman with the belief that it was within the bounds of

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* By ambition here is not meant the worldly ambition of amassing a fortune, but the noble ambition of doing some worthy and useful work in the world.

the probable for her to save a member of her family from even the possibility of any form of insanity, would not devote months, even years, to the study of those principles and conditions of life by which robust health may be maintained? It should not be understood that I would imply that bad food is the cause of insanity, but it can be said that we have sufficient proof to lead us to believe that many cases of insanity might have been prevented had the individuals been properly nourished; of course, it must be borne in mind that this means not only the eating of proper food, but its proper and normal assimilation in the body.

It is woman's province to control and manage the household. Whether she does it wisely or unwisely rests with herself. No one else can absolutely fill her place. She should, therefore, study the phases of home affairs with the same application and assiduity that she would give to a difficult problem, which may require weeks, months, even years, to work out, but which in the end must be solved.

A man enters the arena of business with the full purpose of being master of whatever he undertakes. He knows that he must succeed. Reputation, social position, comfort, progress, the happiness of his family, even life itself, may depend upon his efforts. If woman would feel the same responsibility in regard to her home—that she must succeed in making it a peaceable, health-giving, moral-giving abode, and would never waver until she had accomplished it—we should reach a state of advancement in the understanding of life which, except among some in the cultured classes, is not general to-day. I do not maintain that the study of household science will enable woman to do *all* this, but such study will help greatly, perhaps more than anything else, toward that end. It is one of the important factors in that result, and if for no other reason than that it will make life for women in the performance of their household duties pleasanter, more satisfactory, sweeter, easier, it is more than worth trying. To work in the dark is ever perplexing; to work in the light of intelligent understanding is one form of happiness.

The study of household science, taken in its full and broad sense, leads into boundless fields of research. The phenomenon of heat, the currents of the air, the life and chemical nature of the products of the earth, the mysterious and complex processes of nutrition, fall almost without mention into such work; the sciences of chemistry, physiology, and bacteriology are its foundation stones; in fact, whatever bears upon the physical life of man is included in it.

Now let us consider by what means the women of to-day and of the future may obtain a scientific education in household af-

fairs. I would suggest, first, schools of domestic science and hygiene in which girls shall be taught the subject on the same educational basis and along the same liberal lines that they are taught other things.

A beginning in this line of work (though not in kind) has been in progress for several years in some cities, notable among them the city of Boston. The subject, however, has been taken up in an elementary way and in one of its branches only—that is, cooking. Cooking was introduced to that city by a woman of wealth and benevolence, through whose influence several school-kitchens were opened and maintained at private expense (borne chiefly by her) for a year, to demonstrate to the school authorities and the public what could be done in that line of education. At the end of the time, in the autumn of 1885, the school board decided to adopt the cooking schools as a part of the public educational system, and now there are eleven such schools in that city. Cooking is also taught at public expense in New York, Milwaukee, Des Moines, Washington, Philadelphia, Los Angeles, and in many smaller cities throughout the land. These are for the most part schools in which the making only of dishes is taught. They should be extended to include the study of the sources, composition, and nutritive value of food materials, heat, ventilation, cleaning, serving, and the laws which govern health and disease.

The second method which I would suggest for the extension of our subject is by means of private schools, lectures, and demonstration lessons, by which any person may gain the information which has been suggested should be taught in the public schools. Third, by study and experiment at home, where there is always opportunity for such work. There, by the aid of books and investigation, an educated woman may work out and perfect plans and methods for the management of her home.

Educational and industrial unions, where the products of the culinary skill of women are offered for sale; diet-kitchens, in which wholesome dishes are sold at small price; cooking schools like those in the city of Boston, in which the girls in the public schools are taught methods of cooking; private schools, such as the Boston Cooking School and the New York Cooking School, to which one may go and take one or many lessons in invalid, family, or fancy cooking, and where demonstration lessons are given throughout the year; experimental stations, such as the New England Kitchen in Boston, in which chemical and bacteriological investigations are made upon both cooked and uncooked food, under the supervision of an expert chemist; the Storrs experimental station, in Middletown, Conn., which is a purely scientific school for the investigation of food products and the study of dietaries; Pratt Institute, in Brooklyn, in which an ad-

mirable course in domestic science is offered to those intending to teach—all these in their different lines are excellent, and all tend toward the same thing, namely, better ways of living.

Mrs. Ellen H. Richards, of the Massachusetts Institute of Technology, is the inspirer of the New England Kitchen, and W. O. Atwater, of the National Agricultural Department at Washington, D. C., is the director of the Storrs experimental station. A series of articles written by him and published in the Century Magazine, 1887–'88, are among some of the most valuable contributions (in English) on the subject of food and dietaries that we possess.

Society may be roughly separated into three divisions. In the first are the wealthy and the well-to-do; the second comprises the great and powerful middle classes; and the third is made up of the poor. In the first, the household affairs, for the most part are managed by servants; in the second, by the wives and daughters of the family; and in the third we may say they are not managed at all. If no other than the latter class—the poor—were to be benefited, my plea for the cooking school would have more than ample excuse for being written. Among them, alas! who can least afford it, do we find the greatest amount of waste in cooking, much ignorance in the caring for and buying of food, the most unsanitary surroundings as to pure air and cleanliness, and the greatest amount of sickness resulting from bad living.

The following item alone gives one a glimpse of the misery among the poor: In the city of Baltimore, during the year 1891, in a single hospital thirty-three thousand patients were treated in its free dispensary, and in the same city for the same year $1,250,000 spent in public charity through the various charitable organizations and societies for the relief of the poor.

When we bear in mind that statistics of hygiene show that at least seven tenths of all forms of illness and disease originate directly or indirectly from bad food, bad air, and unsanitary surroundings, and unhygienic ways of living in general, can any one fail to see the infinite amount of good that it is possible to do by establishing schools in which the people may be taught the principles and practice hand in hand of household science?

It is to the public school, not simply a school of methods, but of principles as well, that we must look for the greatest and most lasting good in this direction. There the children of all classes may gain correct instruction in hygienic living; there the subject can be brought to their notice and presented in its true educational light; and there, and there only, can the great middle and lower classes be reached. Private schools may do locally much good, but their influence is not widespread unless they are great. It is only through the public school that this necessary and most

valuable information can be diffused throughout the land; and not the least of the benefit which will come from such work will be the moral effect of intelligent study and the pleasure and satisfaction of working out understandingly some of the many perplexing problems of every-day living.

PREHISTORIC JASPER MINES IN THE LEHIGH HILLS.

By H. C. MERCER.

BEGINNING at Durham, Bucks County, Pennsylvania, and following the trend of the Lehigh hills toward the Schuylkill near Reading, and generally in close connection with veins of hematite, occurs a series of outcrops of the hard homogeneous rock known as jasper. This many-colored stone with its smooth, conchoidal fracture stood somewhat in the same relation to the North American Indian that iron stands to us. With it he fashioned his best spears, perforators, knives, arrowheads, and scrapers. No less diligently did he seek for it than does the man of the nineteenth century search for that great lever of his power and progress, iron; and no less persistently did he quarry it, shape it to his needs, and transport it to great distances.

So Indians in the West had been known to quarry jasper at the now famous "Flint Ridge," in Ohio; novaculite at their great quarries in Garland County, Arkansas; jasper, or hornstone, again in the Indian Territory; quartzite at Piney Branch, in the District of Columbia; obsidian, or volcanic glass, in the Yellowstone Park and Mexico, and other workable stones at other places. But whence the jasper supply came from east of the Alleghanies has long remained a mystery. Even the State geological surveys did not seem to recognize the existence of jasper in the eastern Lehigh hills; so that the recent series of discoveries, by expeditions in the interest of the University of Pennsylvania, have thrown an unexpected light upon the story of ancient man in the Delaware Valley.

The thanks of the university are due to Mr. Charles Laubach, of Durham, who first introduced the explorers, in 1891, to the aboriginal jasper quarry on Rattlesnake Hill, at Durham, Bucks County, Pennsylvania, and to Mr. A. F. Berlin, of Allentown, who, by a series of valuable clews, greatly furthered the work of subsequent research.

How did the Indian, armed only with tools of wood, bone, stone, or beaten native copper, make the excavations, sometimes quite twenty feet in depth and one hundred in diameter? Did he use pickaxes made of deer antlers, as did the ancient flint-workers

of "Grimes' Graves" near Brandon, in England? Did he encounter the rock in solid ledges as in Arkansas, or in loose nodules? Did he reduce it by fire, splinter it with hafted stone hammers, such as are found at the prehistoric copper mines on Isle Royale, in Lake Superior, or by battering bowlder against bowlder? Did he finally chip the material into arrowheads at the quarry, or carry away lumps of the stone to be worked up elsewhere?

These and many other questions we asked ourselves on a first glance at the bramble-grown pits and refuse heaps on the lonely hilltop at Durham. And after a careful study of the place, several

FIG. 1 (⅛).—*a*, CAST OF POINTED WOODEN DIGGING IMPLEMENT; *b*, CAST OF LOG SHARPENED BY STONE TOOLS. Jasper Mines, Macungie, Pa.

expeditions sent out on this and the preceding summer, resulted in the discovery of eight new quarries lying in a continuous line from the Delaware almost to the Schuylkill.*

All, though varying greatly in size and quality of material, tell the same story.

In some, the excavations, filled with forest mold and overgrown with trees, would escape the attention of the casual rambler until the piles of flakes, yellow and rose-tinted, easily displayed by scraping away the leaves that concealed them, revealed the handiwork of the ancient quarryman.

But at others, as at Macungie and Vera Cruz, the passer-by would halt in amazement. The appearance is too unusual, the work too vast—one hundred to one hundred and fifty pits, some of them fifteen and twenty feet deep and one hundred to one hundred and fifty feet in diameter, is no every-day sight. Again, the tinted flakes and refuse heaps tell the tale, and the neighboring

* At Coopersburg, Limeport, Saucon Creek, Vera Cruz, and Macungie, in Lehigh County and at Long Swamp, Bowers, and Leimbach's Mills, in Berks.

wheat field glistens with fragments, yellow, blue, purple, red, lavender, and veined in many hues. The forest, too, has set its stamp of age upon the scene, and an old chestnut stump growing on the side of one of the excavations, upon which we counted one hundred and ninety-five rings, proves that the workman must have abandoned his shaft to the growth of underbrush about the time (1682) that William Penn bought his first tract of land from Indians on the Delaware.

And then, as, standing before the ancient works of the mound-builders at Grave Creek, Marietta, and Newark, a strange feeling

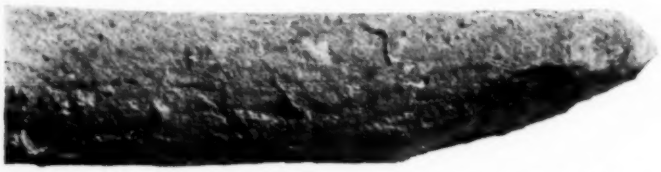

FIG. 2.—PART OF *a*, FIG. 1, ENLARGED, SHOWING STONE TOOL MARKS.

born of awe steals over us, so here by degrees the scene assumes its true hue of wonder. We have had a glance beyond the boundary lines of history into the unillumined darkness of this continent's past, and for a moment heard the echoes of that vast forest mysterious with the fate of lost races that for ages darkened the New World before the coming of Columbus and De Soto.

It was important to learn that at Vera Cruz and Macungie, farmers, believing the excavations to have been the work of early Spanish gold-seekers, had dug deep trenches across several of them to find that some, judging from traces of disturbance in the soil, had reached a depth of forty feet; that one was square rather than round; that in those examined there had been no tunneling done, the lateral enlargements having been made from the surface downward.

In the bottom of two pits it was alleged that charcoal was found, and in one case, deep buried in clay at the very bottom, the remains of a textile fabric, and several decayed billets of wood about two feet and a half in length, with points at one end, blackened by charring. In all instances pure nodules of jasper were to a great extent wanting in the pits, but were found imbedded in the soil as soon as the unworked edges of the excavations were reached.

Our own preliminary work proved that in one of the diggings at least the miners had not attacked a solid vein of jasper, but, finding it in bowlders on the surface, had removed these, to work out others imbedded beneath them; and when in the undisturbed bottom of our shaft, at a depth of nineteen feet, we dug out a small, yellow-coated nodule, we were but continuing the long-suspended process of the quarryman, who, prying out the masses one

by one, must have scraped away the surrounding clay till the pits were made.

That fire had been extensively used on the surface there was no question, whether in the clearing away of underbrush for mining at successive times, or, as seemed probable in one case, in reducing the large fragments, and coloring yellow jasper red.

But far more interesting was it to find fifteen feet down in our shaft an oven designedly made of large blocks of coarse jasper, in the hollow of which rested a mass of charcoal and ashes. To be satisfied that the bowlders had been thus cracked and splintered by heat, it was but necessary to notice their reddened sides and gather up the fire-fractured fragments of all sizes in their cavities.

Several holes in the clay near the bottom were no more nor less than the perfect molds left by objects of wood long since rotted to nothingness, and these enabled us by pouring in plaster of Paris to recover the forms of a piece of sapling about two feet in length, and the fragment of a larger tree, both pointed at one end, and plainly showing the marks of the stone tools that had sharpened them. (See Figs. 1, 2, and 3.)

That one at least of these billets (Fig. 1, *a*) was intended for use in quarrying there could be no doubt; still less that a large disk

FIG. 3.—PART OF *b*, FIG. 1, ENLARGED, SHOWING STONE TOOL MARKS.

of bluish limestone, chipped into the form of a heavy hoe, and well worn on its edges, if not a smaller fragment of quartzite, had been used as rough digging tools. (See Fig. 4, *a*, *b*.)

But as the pickaxe struck fire on the stones and glanced often impotently from the compact clay, our wonder at the ancient toiler's perseverance, challenged by this glimpse of his tools, increased. Still, even granting all the pits a depth far beyond their appearance, we little suspected the immense amount of work done, until the arrangement of layers in our shaft, the scattered bits of charcoal, the belts of stone-chippers' refuse, and the five distinct fire

sites there encountered, proved beyond a doubt that our excavation had not caved in, but had been deliberately filled up by the prehistoric quarryman, who, realizing the economy of keeping the unworked ground free from excessive earth heaps, had evidently carried (in baskets or skins) the newly dug soil from the fresh diggings to the exhausted pits.

FIG. 4 ($\frac{2}{11}$).—STONE DIGGING TOOLS.

Turning to the surface refuse heaps, and from the artificially flaked fragments exhibiting no succinct design that strew the ground everywhere, we find (*a*) a series of well-battered quartzite hammer stones, not pitted on their sides, and varying from an inch and a quarter to five and six inches in diameter; (*b*) a mass of very interesting, artificially shaped blocks, that all tend in the direction of an ideal leaf-shaped form, and which in their various stages resemble the famous implements or objects from Trenton and Ohio known as "turtlebacks" and "palæoliths."

Our attention is further called to the facts that there are few, very few, arrowheads at these spots, and as yet no traces of pottery, no banner stones, net sinkers, gorgets, or grooved axes; that, in a word, these remote places, buried in the forest inconveniently far from water and arable land, were not fit for village sites. They were quarries—nothing more, nothing less—whither the jasper-using modern Indian, as known to Captain John Smith, Campanius, and Kalm, resorted, must have resorted, to quarry his material, knock it into portable shape, and carry it away to the distant village.

By a few blows of the pebble hammer the weathered surface of the nodule (Fig. 7) is chipped away and the thick block takes a pointed shape. A series of further blows, more careful and probably struck with the small hammers, produce a serrated cutting edge around the whole fragment, which now, well marked with the chipping that unmistakably proclaims the handiwork of man (Fig. 5), though still rude, clumsy, and an inch or two thick in the middle, has become the typical "turtleback" of Trenton. It may be that a final series of flakings, whether due still to the hammer or to pressure, results in a quite symmetrical blade, lightened to the desired weight and ready for transport (Fig. 6).

There the quarryman's work seems to have stopped, if it always went so far, and the hoard of blank blades ready to be finished or specialized by some local arrowhead maker into perforators, arrowheads, spears, or knives, as the case may be, is carried away. When for a time its owner is compelled to part company with it, he buries it in the ground for safe keeping or to render the material softer for future work,* and there for a dozen rea-

FIG. 5 (ABOUT ½).—HAMMER STONES AND BLOCKED-OUT BLADES. Jasper Mines, Macungie, Pa.

sons it may remain for long years, to be discovered at last by a surprised plowman.

Such a *cache* of hitherto "inexplicable" leaf-shape implements, consisting of one hundred and sixteen yellowish argillite blades,

* But the flint "knappers" at Mr. Robert Snares's gun-flint works at Brandon, Suffolk, England, told me that they always dried the nodules by the fire or in the wind, as the hammers would not "take hold" of flint wet from the mines. Argillite, on the other hand, so say the quarry men at Point Pleasant on the Delaware, flakes better when wet, as, in my experience at Macungie, jasper does also.

we found, in 1891, on Ridges Island, on the Delaware; another of one hundred and seven of blue argillite was obtained for us by Mr. Doan, at Bridge Valley, Bucks County, Pennsylvania, last May, and another of nine blanks of chert was found by us in June of last year, on an island in the Susquehanna; while on the other hand that the material was sometimes carried away from the mines in the rough, was proved to us by the discovery of a large nodule partly chipped at the village site of Upper Blacks' Eddy, on the Delaware, ten miles from Durham, and another smaller mass on the river shore at Fry's Run.

The story of the Lehigh jasper quarries thus glanced at, but soon to be fully and carefully studied, is thus far a corroboration in main of the recent researches of Mr. W. H. Holmes at Piney

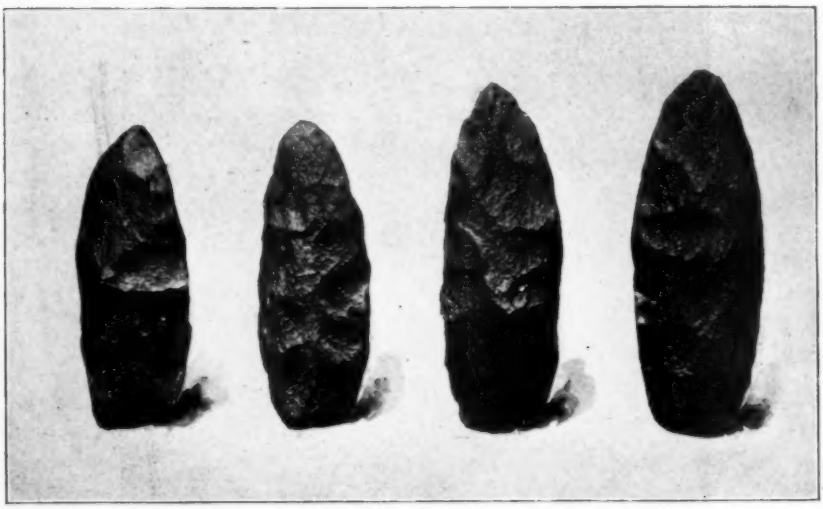

FIG. 6 (½).—CACHE BLADES. Bridge Valley, Pa.

Branch, in the Indian Territory, and in Garland County, Arkansas. Is it the story of all jasper quarries in the United States? Is it the story as well of the argillite sandstone and quartzite quarry sites and the obsidian workings not yet discovered and studied? In a word, are we right in supposing that this process of passing from the shapeless block (Fig. 7) to the "turtleback," and from the "turtleback" to the thin, leaf-shaped blank, and thence to the spear or finished implement, represents the necessary steps through which all peoples in an age of stone have passed in the fashioning of their rock-hewn tools?

Thirty years ago Indians were chipping arrowheads of obsidian and hornstone on the shores of the Sacramento. Many of them still live in the United States and Canada who can doubtless explain the whole matter. Sometimes their opinion has been asked

and their work described, but the accounts of their white questioners have been vague, contradictory, and unsystematic. None of them explain the quarry, the turtleback, or the *cache* implement.

Caleb Lyon, who saw about 1860 a Shasta Indian arrowhead maker at work, refers only to a slab of obsidian one fourth of an inch thick, split from a pebble and flaked by blows. T. R. Peale speaks only of hammering a mass of jasper, agate, or chert with a round-faced stone and finishing up the edges with a notched bone, as a glazier chips glass. Schoolcraft saw an anvil of wood or some hard substance placed on the thigh, upon which a piece of jasper was held at rest to be hammered by something undescribed. Captain John Smith tells how the Indian "quickly maketh an arrowhead of splints of stone in the form of a heart, with a little bone, which he ever weareth at his bracept." Torquemada and Hernandez briefly describe seeing Mexicans sending off long flakes of obsidian, with which certain Spaniards had their beards shaved, by pressing a wooden punch on a nucleus of obsidian held between the feet.

FIG. 7 (ABOUT ½).—NATURAL NODULE OF JASPER FLAKED ON ONE SIDE. Long Swamp, Lehigh, Pa.

Admiral Sir E. Belcher (about 1858–'60) saw Eskimos, California Indians, and Sandwich Islanders fracturing chert blocks with slight taps of nephrite hammers, and then flaking the splinters wedged in a spoon-shaped cavity in a log, with a point of deer horn.* And so on. Lieutenant E. J. Beckwith and Catlin tell of flaking small pieces and thin slabs of quartz and obsidian, by direct pressure and indirect pounding upon a bone punch; and certain white men have recently made arrowheads out of curiosity or to palm them off upon collectors; but neither the conflicting accounts nor the amateur experiments explain the leaf-shaped hoards (Fig. 6), or the inchoate forms (Fig. 5) that litter the quarry refuse. Evidently some of the chief underlying features of the first and greatest of man's primeval arts have not been grasped. The living Indians who remember the process must be questioned again.

* See for these narratives, except Beckwith (Pacific Railroad Survey, vol. ii, p. 43), E. T. Stevens's Flint Chips, p. 57.

Turning back to the quarries and refuse heaps, and passing by the many problems of deep archæological interest that they suggest, suffice it here to say that for one fact already mentioned they claim attention among the foremost fields of American research.

Here, at a distance of from forty to fifty miles from Trenton, are scores of jasper specimens closely resembling the forms of argillite found there buried fifteen and twenty feet in the glacial gravels; imitations, so to speak, of the so-called "palæolith," or

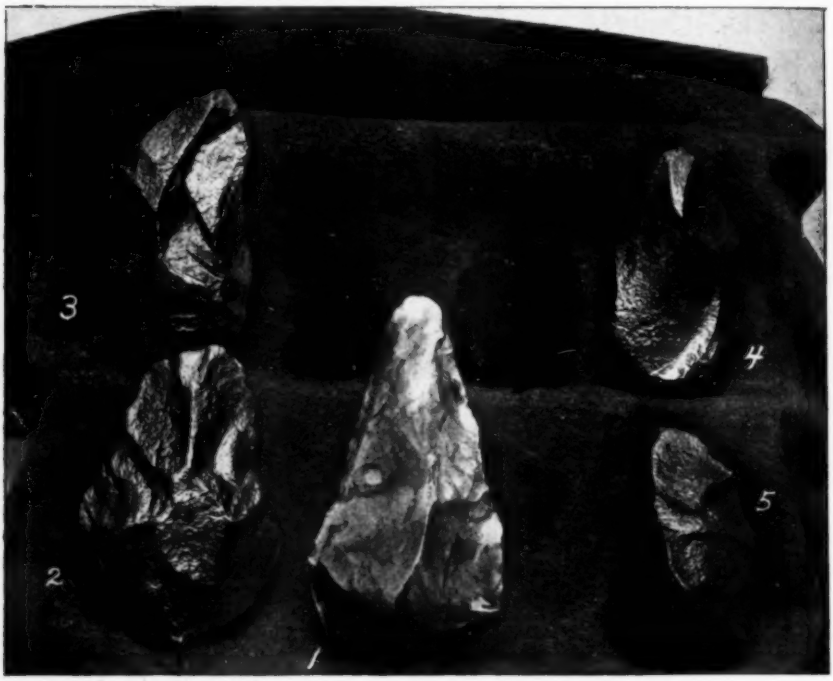

FIG. 8 (½).—1, FLINT PALÆOLITH FROM ST. ACHEUL, FRANCE; 2, 3, 4, 5, TURTLEBACKS OF ARGILLITE, DELAWARE VALLEY. (Found on the surface.)

implement of the savage ice man, who, seven thousand years ago, chipped river pebbles on the freshet-swept banks of the Delaware.

We have been told that this object from Trenton, this "palæolith," is a finished implement, a type of an epoch; that the savage who fashioned it was little better than an ape in culture, ignorant even of the use of the bow, and a slayer of his prey with clubs and stones. And science has willingly stolen into the by-paths of wonder and speculation to suggest his origin and fate. Akin it was said to the river-drift man of Europe, he crossed the North Atlantic on an isthmus that in preglacial times stretched from Britain to Greenland to dwell on the cold shores of the Delaware when the great glacier stretched its coping of ice from the Hud-

son's mouth to Oregon, and while the Niagara River yet tumbled its cataract into Lake Ontario at the site of Lewiston.

At first, as we take up these shapes from the quarry (Fig. 5), rude as the rudest from Trenton, yet geologically an affair of yesterday, doubts assail us on all sides. What if the Trenton specimens, after all, are modern too? Did they slip downward into the drift through the fissures of earthquakes, root-holes, the cavities left by upheaved trees, or by the deceptive readjustments of strata that sometimes puzzle geologists on the face of bluffs and banks? The supposed lapse of ages between them and the Trenton implements seems to fade away. We are almost startled. The doors of archæology's wonder chamber have been thrown open, its treasures displaced, and the strange form of palæolithic man, slipping out of our grasp, seems ready to vanish into the limbo of chimeras.

But pondering long over the work of the quarries, and comparing it diligently with the workshop refuse on the pebbly shores of the Delaware and Susquehanna (see Fig. 8), where argillite "turtlebacks" (Nos. 2, 3, 4, and 5) are often found at Indian village sites, ideas suggest themselves that may well efface all bias from our minds, and effectually disincline us for a premature conclusion.

What if these modern stones (Fig. 5) do resemble "palæoliths?" What if the Trenton forms like these were only steps in the process of fashioning blades not yet found? What if the Trenton "palæolith" were not a finished implement, as has been declared?

What if glacial man, in a word, was not a "palæolithic" man at all, ignorant of the art of stone-polishing, but the equal in cultivation of even the modern Indian?

Is he any the less old? Is he any the less interesting because we can no longer pick up a stone, like the American specimens in Fig. 8, on the surface and say, "This is a palæolith"? Is he any the less a glacial inhabitant because modern Indians have duplicated one of his stone relics, and we are obliged to reform our American definition of the word "palæolithic"?*

As we tread the rough, hilly roads and clamber the rocky slopes that often lead to the jasper mines, nothing strikes us more forcibly than that man must have been a long time a dweller in the Delaware Valley before he discovered them, and that his first

* We speak in America of "palæoliths" and "true palæolithic implements," as if the terms could mean nothing but the rude forms here discussed. But the cave men of France, who, it is said, did not polish stone, though they polished bone and produced realistic animal carvings superior to anything done in the bronze age, were no less palæolithic than the drift savage who made Fig. 8, No. 1. And if Sir John Lubbock's definition means anything, the delicate blades of chipped flint from Solutré and the caves of Laugerie Haute, Gorge d'Enfer, Grotte de l'Eglise, etc., skillfully worked as the beautiful obsidian knives of California, Tennessee, and Mexico, are true "palæoliths." (See De Mortillet, Musée Prehistorique, classification.)

stone implements would have been fashioned, not from jasper, but from the material first at hand.

The shores of the large rivers, where no one denies that he made his earliest habitation, are strewn with pebbles of convenient size and conchoidal fracture, and from these (who can doubt it?) he made his first tools, whether already elsewhere taught the value of jasper or not.

From Belvidere to Chester, from Beach Haven to Havre de Grace, the river beaches may be looked upon as one great pre-

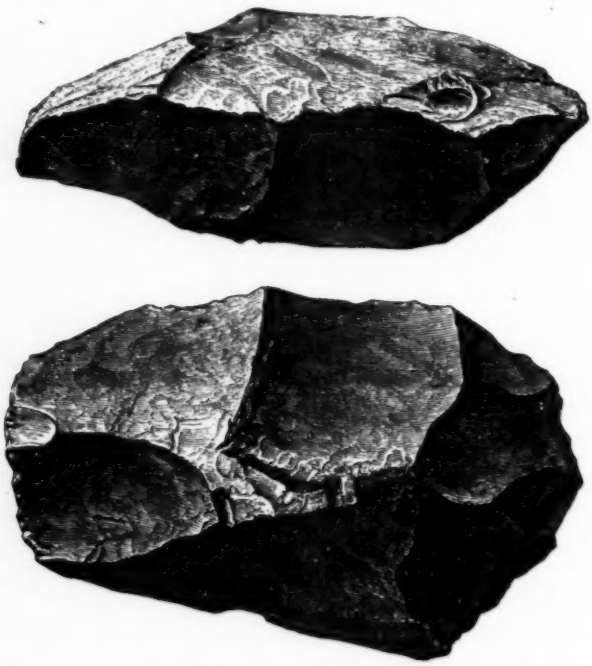

FIG. 9 (½).—TWO VIEWS OF A SPECIMEN FROM THE TRENTON GRAVELS.
(See Abbott's Primitive Industry, page 500.)

historic quarry littered with the chips, the hammer stones, and the refuse implements of vanished peoples; and while the remote jasper quarries were disassociated of necessity with abundant traces of village life, here were quarry and village sites combined, where the relics of the stone-chipper must needs lie within a few feet or yards of those of the potter, the fisherman, and the hunter. It is here rather than upon the hilltops of Durham and Macungie that archæology may look for man's earlier and intermediate handiwork in stone, the telltale sites whose relics more or less deeply buried shall carry us back to the morning of his first coming.

Meanwhile, with eyes wider open, we are ready for another ransacking of the gravel pits of Trenton and Madisonville. More

sharply than ever shall we look for a bit of pottery seven thousand years old, an arrowhead or grooved stone axe, and without unjust doubt ask the questions: Have we been deceived? Have the classic stones slipped down into the gravel through Nature's channels? Has a landslide tricked us with its mastodon's tooth and human skull? And then, where are the hammer stones, and the chips, and the signs of use on the "turtlebacks," and the thinned-down blades, which shall prove for what purpose glacial man might have made these leaf-shaped forms—whether like the modern Indian he treated them only as blocked-out types of more specialized tools, or whether, still a child in the stone-chipper's art, he halted at the second step in the process, and, unskilled to go further, used the now famous "turtleback" as a finished implement sufficient for his primitive needs?

It is well that we have this new light from the jasper quarries on the great art of arts that most concerned man's life and happiness in the untold ages of his childhood. One source of error and confusion has been cleared away from the subject, and we fully realize that what shall in future determine the age and nature of these stones is not their "type" or their form, or their resemblance to European specimens, but their geological position.

ORIGIN OF LITERARY FORMS.

By M. CHARLES LETOURNEAU.

WHAT in current language we call literature, the literary æsthetics of civilized peoples, poetry intelligently composed and revised according to complicated metrical laws—written works, made to be read, not sung, and addressed to a cultivated public—only represent the last term of literary evolution. Primitive literature is very different, and is everywhere the same. Its origin is extremely distant, and it is probable that it even preceded, in our most ancient ancestors, the invention of articulate language—that great step which sealed the transformation of the anthropopithecus into man. That precious acquisition, however, was not miraculous nor instantaneous. The first speech was certainly very rudimentary; and before conquering it, the anthropoids from which man slowly issued possessed, like all other animals, a vocal language constituted solely of modulated cries resulting from simple reflex actions, automatic, and corresponding to the necessities, the desires, and the feelings of beings of little intelligence. In the brain of the anthropopithecus the passage from the cry to speech marked the beginning of a complete psychical revolution. It must have been effected with great slowness, and

supposes a life in society of a cyclic duration, for the isolated infant still does not speak. The first words were probably cried or sung. Our very young children still sing before speaking, and even begin with singing their first articulated sounds; and not till they are three or four years old is their speaking voice clearly distinguished from their singing voice.

As in the human species the singing voice is much the most ancient, it has also left very deep impressions on our mentality. Certain cries, certain *timbres* or modulations of the voice, will to-day awaken in the most civilized man latent and profound impressions, and excite emotions that seize the hearer's very heart. From this psychic basis bequeathed to us by our ancestors, from this mental paleontology, are derived our taste for music and its emotional power. Those cries, those passionate accents, have more power over us than the most moving discourse, because they have been, through the long chain of ancestral generations, the expression of intense feeling of which we have not ceased to be susceptible. At the bottom, traced back to its origin, music is nothing more than the æsthetic imitation of particularly expressive vocal emissions; consequently its psychical roots go down very deep into the past, to the time when man began to be differentiated from the animal. It is, therefore, very much of course that in all races song should constitute one of the principal elements of primitive æsthetics. This is a fact that we have been able to verify everywhere, even among the most inferior types of men, as among the Pécherais of Terra del Fuego, whose song constitutes in itself alone all their æsthetic expression. Yet this is a rare, an exceptional fact; for usually, in primitive æsthetics, song is closely associated with gestures and mimicry, which, from the origin of our species, were probably secondary to the voice not yet spoken, illustrating the significance of the cry; for vocal sounds and gestures are equally reflexive acts, and the voice is only the result of muscular contractions, of laryngeal gestures.

The more rudimentary articulated language is, the more necessary to it is the aid of mimicry. Our children gesticulate long before they have learned how to talk, and they continue to do so long afterward; and we first succeed in communicating with them by means of gestures. Even the adult man, of the highest civilization, rarely confines himself to articulate language alone. Nearly always gestures are added automatically to the words, to sustain them, as comment, or to moderate or intensify the expression. The refined rhetoric of artists in speech makes great use of mimicry, and the ancient rhetors of Rome esteemed action very highly. The literary æsthetics of all primitive peoples, therefore, comprised at once song, speech, and gestures. Thus we have seen the men of all countries and all races beginning in literary

æsthetics by blending into an indissoluble trinity mimicry, music, and poetry, or, in short, song and the scenic dance. In fact, as we have often shown, articulate speech begins by being the least important member of that æsthetic trinity; a simple accessory of the song—that is, of rhythmical, cadenced modulations—it defines their sense, but can not separate itself from them, and often gives place to simple modulated cries, to interjections, and to onomatopœias. In fact, with different primitive peoples, we have found species of romances without words, traces of an ancient interjectional poetry which probably preceded spoken poetry. The interjectional refrains, frequent among primitive men and in our popular songs, are evidently survivals of this same æsthetics.

We have seen that in all the earth the object sought by the primitive peoples in their dances and ballets is less the pleasure of rhythmical motion, to which they are, however, very sensitive, than significant, scenic mimicry, reproducing acts and adventures fitted to excite a lively interest in the little social community of which they form a part. What they want most of all is an expressive spectacle, giving the idea of a hunt, a battle, a cannibal feast, and their incidents; but such a dramatic ballet supposes the existence of a close association, of that communal clan which we meet in the origin of all societies, and which has everywhere modeled primitive æsthetics. These choral dances, these opera-ballets of savages, constitute in all races the collective rejoicings or ceremonials of the clans. We have found them among the Tasmanians, the Papuans, the Kafirs, the Polynesians, the American Indians, the Hebrews, the Greeks, and other nations. These scenic diversions always represent events of capital interest for the little social unity; and the nature of the events differs according to the degree of civilization. With the American Indians, they refer to the hunt or to war; with the Chinese, to different incidents in rural life, labor, the harvest, etc.

These beginnings of literary æsthetics explain to us why, among civilized peoples, music excites many persons to movement, to action; it is because the two were long associated in the ancient clans. But it addresses itself to very intelligent persons, with whom the necessity for muscular activity yields to that for mental activity, to the feelings, to the thought, when music, instead of exciting the muscular system, awakens the heart or stimulates the mind. It, for example, inspires in a Stendhal the desire to cooperate in the enfranchisement of Greece; in an Alfieri, plans for tragedy; and in a John Stuart Mill, philosophical speculations. In all these cases, in short, music plays the part of an excitant that determines different reactions according to the various modes of the mental organization.

The taste for measured, rhythmical musical sounds is, as we

have seen, both primitive and universal. From this very taste has sprung the invention of meter, or the art of closely marrying the words to the melody, and consequently of counting the words and even the syllables of the words when they have more than one, of regarding their accentuation in chanted poetry, the only form that originally existed. In the primitive choirs the air was the most important element; the words were probably regulated by it. They were fitted at first with much difficulty and very imperfectly, by recourse to exclamations, to interjections void of sense, in order to fill blanks and create rhymes. Sometimes among very inferior races the rhyme and the pleasure of pronouncing it were obtained by simply repeating a word or a short phrase, as the Fuegian and the Australian do. Very commonly the essential element of the meter is the more or less imperfect rhyme, the rhyme by assonance. The verse without rhyme of some civilized peoples, like the Greeks and Latins, which depends chiefly on the tonic accent of the words, supposes a language developed and highly refined; but at bottom it also rests on combinations of assonances. The primitive songs never being written, very imperfect rhymes sufficed for them. It is only among civilized peoples that meter becomes learned and complex, when poetry is almost entirely in the hands of professionals.

Usually when meter becomes more rigorous the length of the verse increases. Taken by themselves long verses indicate a refined civilization and a perfected literary æsthetics. The primitive verses are nearly always short, partly because they express short ideas, and partly because the desire for the repetition of agreeable sounds and the taste for rhymes or what represents them are more lively as man is less developed.

In China, where metrical evolution can be followed step by step, the verse in use has passed very slowly from four feet to seven feet. Arabian verse has been expanded in another way—by combining two short verses in one; and in a like way in the French Alexandrines the hemistich is a survival of a former epoch when the verse was very short. In India, Sanskrit verse, uneven but generally short in the Rig Veda, has been lengthened in the epics to fifteen syllables, with a hemistich.

Poetic diction, with its music and its meter, enjoys everywhere a peculiar prestige. It gives play to æsthetic impressionability, and has a dignity unknown to common language. On the other hand, verse easily engraves itself in the memory, and the ideas which it expresses form a sort of mental fund to which a great importance is attached, for the choral poetry of the primitive peoples sang only of subjects especially interesting to the community. Hence it comes to pass in many countries that even in the heart of old civilizations, far detached from their origin, the

poetic form suffices to give any idea a great authority. "Among the Indians," says an old missionary, "a verse, even when quoted inappropriately, gives a great weight to reasoning, and if it contains a comparison that seems to illustrate some circumstances of the subject under discussion the very best reasoning can not have equal force with the comparison."* In the same way Arabian orators fancy they obtain great force for their speeches by larding them with citations in verse; and the Greek writers believed it necessary to give the poetic form to every elevated subject, even to their philosophical systems.

During the primitive period of literary evolution abstract literature does not come in question; moreover, poetry in words is never separated from song, and rarely from mimicry; and this becomes dancing when the motions are controlled by a musical rhythm. Frequently, also, in these archaic festivals the words sung are only an accessory.

The characteristic traits of the clan, the first social unity, are now well known to us. The primitive clan is a small group, in which the individual exists only as an integrant part of the whole, where consequently all individual acts are subordinated to the interests and needs of the social body, where no one is abandoned but no one is free, where property is more or less common, and where sexual unions are subject to regulations that seem to us strange and even immoral, for they have usually a character of restricted, regulated promiscuity. These narrow associations have been real psychical laboratories to the human race, in which languages, indispensable for mutual understanding and the concentration of efforts, and myths have been created, besides common feelings, and particularly altruistic feelings, without which no society could endure.

In the communal clan there is little place for person and for literature, and literary æsthetics necessarily takes the shape of a collective spectacle—of those choral dances, those opera-ballets, in which all the members of the clan are in turn actors and spectators, and in which mimicry and song are associated to represent scenes of common interest.

In these very rudimentary dances instrumental music figures at first only as an accessory, but its function goes on increasing in proportion as it is perfected. At first it is contented with a stick, such as the Australians strike on the ground to mark the measure; then the stick is replaced by the tom-tom, which fills the same office more perfectly. To the tom-tom are added in succession, first, wind instruments, then stringed instruments, both becoming gradually less primitive and better constructed, and at

* Lettres édifiantes, vol. xiii, p. 113.

least capable of accompanying the song, and, as a final achievement, of taking the place of the voice in the execution of any given air. History witnessed the latter part of this musical evolution in Greece, where music finally separated itself from vocal song, of which it had for a long time been only an accessory.

As of necessity, poetry proper has strictly followed the transformations of this æsthetics. For a long time the subjects represented in the choral dances of the clan had an entirely impersonal character. These subjects were mythological, warlike, funereal, and nuptial scenes, in which the rhythmical words had necessarily to express ideas and feeling in harmony with the scene played. It is not necessary to say that these feelings and ideas were extremely simple; but in substance and form they were of a nature to interest the whole of the little social groups.

The duration of the primitive age of the communal clan must have been enormous, and it has marked its impression on the larger and more and more individualist societies that came out from it, but which did not free themselves in a day from the hereditarily transmissible tastes and tendencies—the legacy of a long ancestral education.

Nevertheless, literary æsthetics has suffered modifications with the progress of social evolution; for it has had to express feelings and ideas more and more complex and varied. With the progress of differentiation, or of social inequality, arose numerous conflicts between the strong and the weak, the patrician and the plebeian, the rich and the poor.

These vexations, these violences, suffered by some and exercised by others, excited numerous new feelings, and often more personal, than the ancient choirs could express and re-echo to their hearers. The property thus became more and more individual, and there resulted from it a gradually increasing restriction of the social relations which the communal clan had only loosely regulated. The restricted promiscuousness of the early ages was replaced almost everywhere by a marriage, sometimes polygamic, sometimes monogamic, but legal, and making of women things possessed. The ancient liberty of love was abolished, but the genetic instinct is in its nature exacting and rebellious. When we attempt to chain it we excite passionate desires, intense feelings, that subjugate the whole mental life. The genetic fetters resulting from the new social organization will therefore arouse in the human brain new impressions and ideas of shades different according to the individuals. But all these psychical elements, at once new and intense, sought expression and reflection in a literature made in their image. Hence resulted the gradual blooming out of a new lyric poetry, which gradually tended to substitute itself for the choral lyric of the earlier ages.

From this phase dates amorous poetry, which was destined to take so large a development. There are good grounds for supposing that women may have especially participated in the creation of this lyric of the erotic kind. This is still the case in some Slavic countries and in Kabylia; and it is possible that in Greece Sappho only gave a brilliant personification to a more especially feminine literature, of which few specimens have come down to us. The lyric poetry of men is less confined to the domain of the amorous feelings. It touches more varied subjects and those of a more general interest, notably mythical and historical legends, capable of interesting a whole virile population, but possible to be versified and sung by isolated artists.

To accompany these individual songs of every kind, suitable instruments were needed, not noisy enough to drown the voice of the singer, but of sufficiently extensive register to follow all the shadings and modulations. Stringed instruments happily fulfilled this purpose; and thus all the superior races have invented or adopted them, while in Greece, one of them, the lyre, served to give a name to passionate and personal poetry.

By virtue of their improvement, literary arts, song, poetry and instrumental music became difficult of practice. To perform them required a special education, while in principle everybody could participate in the execution of the primitive choruses. Then appeared those popular artists, of whom the Hellenic rhapsodists, the Scandinavian skalds, and the Celtic bards are the best-known types, but of whom we find a few everywhere, even in tropical Africa, in Polynesia, and among the Tartar, Kabyle, Finnish, and Slavic populations.

At first these barbaric songsters limited themselves to following their own inspiration; but they were not slowly subjected to powerful influences. The priests on one side and the kings on the other attached them to themselves, and required them to sing the mythical legends or the achievements of their heroes and princes. Outside of these official subjects the professional bards took for the themes of their compositions everything of interest to their fellow-citizens that presented itself, and became thus the poetic annalists of all notable events. These poets, most frequently wanderers, were the first to give precise form to the popular traditions current among the people, and their songs, transmitted from generation to generation, constituted the material for the epics composed much later by less inspired but more skillful artists, at a period when epic customs were only a recollection.

We find many occasions showing how closely literature depends on the social and political state. At the origin of societies, during the age of the communistic clan, literature, always very poor, is the exact expression of what might be called the collective

soul. When the sacerdotal castes, aristocracies, and despotic monarchies have been instituted, when power and wealth are concentrated in the hands of a minority of privileged persons, the great revolution has an influence at once useful and injurious upon literature. Encouraged, corrupted, and exploited by the directing classes, by the worldly fortunate, poetry gains much in form and technics; meter ceases to be simple; the gross assonances of the past no longer suffice to charm more refined audiences; exact rhymes are required, and a skillful adaptation of syllables to a rigorously determined quantity. At the same time, poetical compositions cease to be only oral. They are written, and prosody must at once satisfy the eye and the ear.

The substance is modified along with the form, and becomes aristocratic like it. Certain gross features, which formerly shocked no one, are expunged; but with this the poem suffers a loss of its naïve grandeur, its sincerity of standard, its epic charm. When they undertook to protect and reward poets, the powerful classes ruled them always, even without desiring it; whether they knew it or not, they took them away from some subjects and imposed others upon them. On the whole, the final result of this high patronage is usually lamentable; and by the single fact of its existence, sincere, elevated, independent literature, the only kind that is of value, languished and expired under the rule of the "grand monarch," Louis XIV. What was left was only a shadow, an attenuated poetry, which chiseled out the form without caring for the material; which, having no ideas to express, juggled with the words, and saw nothing but the melodic side in the verse; in short, an inferior poetry, which tended to confound itself anew with its twin sister, music, which it had previously had to quit in order to think better.

The evolution of the dramatic art was effected in a nearly parallel line with that of lyric poetry. Even more rigorously than that, dramatic literature is the slave of the social state, because it has necessarily a collective character. In the course of our studies we have found the general opinion, according to which the theater is the literary expression of an advanced civilization, to be false. On the contrary, the dramatic species goes back to the very origin of literary æsthetics, for choral and mimic dances constitute nearly all the literature of primitive peoples, and a rudiment of scenic art has been found, even in Tasmania, among an extremely inferior race. In reality scenic poetry preceded all other kinds, and most frequently constituted their mold. By the simultaneous employment of mimicry, song, speech, and instrumental music, the opera-ballet of the early ages was the form of æsthetics most fitted strongly to impress spectators and actors, and at the same time to satisfy a very lively psychical want, that

of projecting mental images outward, of reproducing with all the relief of reality what exists in the brain only in the state of recollection or desire. The civilized theater is only the natural development of this opera-ballet, and it preserves an equal attraction and an equal power, even after losing the lyrical form, which dated from its origin.

Dramatic art was even more than lyric poetry subjected by the dominant classes; and in Greece, in India, and in Europe of the middle ages the clergy of the great religions seized such a powerful means of expression, confiscated it for a longer or shorter time, and even permitted it only with reluctance to become laic. Dramatic art being an essentially collective sort of literature, addressing itself to the multitude, could not express more than the average of the prevailing opinions, of the ideas current in the surrounding social medium; too original views, too special feelings, were not in its domain; in return it is, more than any other kind of literature, the reflection of the mental and moral condition of a class, accordingly as it is popular or aristocratic; and instead of correcting manners it continually confines itself to depicting them. In the golden age of Greece the theater was lyric and heroic; with social and political decay, Hellenic tragedy could not stand the competition of satirical comedy, which is a social protestation. At Rome, where social iniquity was at a very early period more crying than in Greece, the theater never had a heroic age.

In all times and in all countries literature has declined morally, and has lost its nobility, its force, and its æsthetic beauty, in periods of moral decomposition; but the first of all kinds of literature to be debased and corrupted was dramatic, for societies could not support any theater above their own standard. On the contrary, lyric poetry, compositions entirely personal, might protest as survivals for a longer or shorter time against the general decadence by expressing the sentiments of the minority, which will never bend to the new manners. In dramatic literature, or in literature in general, for the observation is true for all kinds, there is a sign of decadence no longer moral but intellectual, which is constant and which I will now point out. When we follow the evolution of literatures from their infancy to their old age, we are struck at seeing how, during their period of growth and vigor, they make little account of an æsthetic element, which is highly esteemed, on the contrary, in periods of decline; I mean what is called "the feeling of the beautiful in Nature." In the choral poetries this element is wholly wanting; they are preoccupied solely with mythical conceptions of subjects of social interest. In general, during the virile age of literatures, descriptions of landscapes hold only a very accessory place; on the other hand,

descriptive literature develops beyond measure during the period of decadence, as has been observed in China and India, where the excess and often the insipidity of the word-paintings overwhelm the chief subject of the poems. This belated taste for description seems, therefore, to be a characteristic symptom. It indicates that literary vigor is exhausted; that the writer has few ideas, or is restrained from expressing them; or that political liberty is dead, social sympathy is extinct, and intelligence is reduced.—*Translated for The Popular Science Monthly from the Revue Mensuelle de l'École d'Anthropologie.*

THE PSYCHOLOGY OF LIZARDS.

By M. J. DELBŒUF.

I PUBLISHED two articles in February and October, 1891, telling of two ocellated lizards which I had captured in May, 1890—one at Port Bon, on the borders of Spain, the other on the banks of the Tarn, near Peyrdean, France. I described their characteristic differences at length, telling how the former lizard was bold, snappish, suspicious, and stupid; and the latter was timid, gentle, confiding, and straightforward. I told how the French lizard having been lost for twenty-six days in May of the following year, the Spaniard refused all food; and how, his companion having been found again, he went at once to catching flies. I praised their good understanding with one another, and their fellowship, which, however, did not extend to self-denial; and I related with great pleasure how, by forbearance and kind attention, I finally established excellent relations between myself and the Spaniard, while only a few delicate attentions were needed to gain the heart of the French lizard from the very first.

I concluded that the animals which we are accustomed to regard as in the lowest degree of intelligence among vertebrates, and which we are apt to suppose are all cast in a common mold, offer notable differences in character and docility. Yet, since those which are under consideration here are adults, they have necessarily each received the share of force and cunning which was indispensable to enable them to come safely out of the struggle for existence. Whence do their peculiar qualities come, and what use do they make of them? In wild animals, whose mode of life presupposes a well-determined combination of native qualities which age can only develop and strengthen, should not differences tend to disappear?

What I have to relate now is not less curious than my former

story. I do not even know—although like observations ought to be made on domestic animals like the dog—that the bearing of them as traits of animal psychology has been brought out. My Spaniard is certainly a lizard apart. He is somebody.

But before going into individual details, I will add the final to the incidents which I have already given concerning my lizards. I have had them three years, and they have kept in admirable health. They have not hibernated, for the house has been kept warmed all the time, and their cage has been near a register. They have therefore been all the time wide-awake and very active. From this we conclude that hibernation is not organic with them like the rest of plants, and that it is a consecutive of cold weather, which causes besides the disappearance of the insects on which they feed.

Their food, therefore, does not necessarily consist of living prey. They eat with the same appetite the remains of beetles, such as the skeletons of night borers, and all decayed or dried chrysalides. Last year, the cabbage butterfly being extremely abundant, I collected a stock of chrysalides which they devoured to the last one. They always refused raw and bloody meat. Nevertheless, when they were forced to swallow it, which was not easy, they digested it.

They are said to be fond of grapes, and in vine-growing countries, I was told, hunt for the fruit. But with me they never wanted grapes, not even the southern variety or the dried raisin.

On the other hand, they are fond of dates, and attacked them with avidity the first time they saw them. I made them up some balls of dates as large as a good-sized grape, of which they were able to swallow three or four one after another I received other ocellated lizards last year, and they all liked dates, one of them to my surprise gulping down a whole one in a wink. It agreed with him perfectly, his digestive powers, as I took pains to observe, proving adequate to dispose of the stone in a proper manner, although my friends feared that it would be caught in the sinuosities of the intestine, with perhaps fatal effects. It seems that this animal estimated rightly the capacity of his digestive apparatus. The preceding curious feature in the present case is that all the lizards at once recognized an eatable fruit in the date, although they had never seen or tasted dates or anything like them. They may have eaten figs at home, but they refused dried figs.

All my lizards lived, I might say, in freedom. During our summers in the country, they had a large room with latticed windows, with sunshine on three sides. They had stones and boxes of every sort, and for a gymnasium convenient scaffoldings furnished with rags in which they climbed, hid, and chased one another with evident amusement.

At Liége they live in my office. They usually keep in their cage, where there are also rags. When the sun is shining, they come out and scramble among the books or over me. The Spaniard looks at me when I am writing. They run over my person, hide in my clothes; and one day last year I had so completely forgotten them that I went out to deliver my lecture with my two animals on my back. I perceived them after I had been some time on the lecture stand, and was in mortal terror during the rest of the lesson, lest they might take a notion to perform their untimely and undignified gambols.

As my children, too, are fond of playing with them, they are always under observation. My articles have given them a European reputation. M. Tarde, the eminent sociologist and criminalogist, passed eight days with them. M. Forel, the celebrated student of ants, found them after a few days as interesting as his ants. They were intimate with a learned English psychologist, M. Waller, and his wife, and had the honor of being presented to eminent physiologists like M. Morat and great poets like M. Jean Aicond. They have even been invited into society and caressed by beautiful and noble ladies, whom they conquered by the grace of their motions and the beauty of their dress. Thus they have acquired gentle manners and are in safe and agreeable relations. Man inspires no fear in them, and they play indiscriminately with all visitors who encourage their familiarities.

When they play in the light and make turns in their gymnasium, going out, re-entering, putting their noses against the window, turning their pretty heads, or flattening their backs in the sun so as to receive more of its rays, they really present a charming spectacle; and I think, not without a shade of sadness, how nearly some countries would resemble a terrestrial paradise if man, instead of making himself the terror of everything living, would become its protector and friend.

All my lizards but one come at my call, whistle, snapping of the thumb, or *psitt*, to take flour worms or dates. They know where their larder is. When we go to the worm keg, they divine what it means, and are all on the alert, manifesting their expectation with unequivocal signs. The Spaniard, at first the most savage and stupid, became the most familiar and apparently on the best understanding. Not only was he not afraid of being taken, but he seemed to find pleasure in it, and suffered himself to be caressed for hours without giving a sign of weariness. He liked to be scratched under the jaw, however roughly.

The story of the way this transformation from wild to gentle was brought about is long but suggestive. MM. Sabbatier and Robert, of Montpellier, and M. Tarde had promised to send me ocellated lizards, but had not been able to fulfill their promise.

I was regretting it, when M. Winssinger, an engineer of Brussels, put me in communication with one of his friends, M. H. Dineur, Director of the Mines of Fillols, near Prades. He sent me an ocellated lizard on the 1st of October, 1891. This lizard died by being inadvertently smothered, at the end of March in the next year. The autopsy disclosed that it was a female; it weighed only fifty-six grammes, while the Spanish lizard weighed more than one hundred and thirty grammes, and the one from the Tarn more than ninety grammes. The Spanish lizard was a male.

It possibly came to pass that the young female disturbed the harmony between the Spanish and the French lizards, for I observed that they no longer lived on a footing of complete intimacy. I observed at ffrst only scoldings between them, but these were succeeded by bitings. In the beginning the quarrels were transient, but they became more and more frequent, and the acts of hostility were graver—the Spanish lizard, presuming on his strength, pursuing his rival, driving him out of corners, biting him, and at last rendering his existence so miserable that I was obliged to separate them. After the tragic death of the lizard of Prades, I hoped there would be a reconciliation, but there was none. The French lizard, indeed, made several attempts to establish peace, but the Spaniard sprang upon him furiously as soon as he perceived him and made him scamper his fastest.

M. Dineur sent me other consignments of lizards, six in all. One very small one escaped into the field; another died a little while after its arrival. It was a very fine animal, but it had sharply bitten a workman who picked it up, and the stupid and cruel brute took his revenge upon it by making it bite a bar of red-hot iron. Its mouth was all a sore when I received it, and it survived its horrible burning only a few days.

Among the four new lizards that were left me was one formidable one, which, although it lost most of its tail when it was captured, still weighed nearly two hundred grammes. They very soon became familiar, except one, which, while it would eat from the hand, persisted in running away if one tried to pick it up, and bite when it was captured. The Spanish lizard received them hospitably, but if I put the French animal among them he would immediately recognize him and chase him.

But after some weeks of peaceful living together, the Spanish lizard began to tyrannize over his new companions too, the largest at first and then the smaller ones. He is a decided teaser and a bad bedfellow. Nothing can be more curious then the tactics he employs to cut off their retreat. He turns himself crosswise, in such a way as to bar their passage. Then, when he has driven them into a corner, he lifts up his paws, swells out his neck, puts down his head, darts his great open mouth at them,

and bites them on the head, the flanks, seldom on the paws or tail. The large lizard in particular was the favorite object of his attacks. The good-humored animal paid no attention to this, till we were on the point of asking ourselves whether he did not regard these bitings as marks of friendship. This lasted some two or three months. But one fine day—we were present at the scene—the large lizard became impatient. He seized the Spaniard with his formidable mouth, shook it, let it go, and then set in chase of it. The other ran off as fast as he could, giving all the signs of terror. After this the large lizard became quiet, and even seemed to have forgotten the matter.

The Spaniard took no notice of the generosity of its antagonist. Only becoming more prudent, it devised other tactics. Pretending indifference, it approached the Hercules slyly and a step at a time, and when it was near enough to him struck him with its jaw and ran away. Finally, the large lizard concluded that the Spaniard was too provoking; he sprang upon it anew, caught it, and gave it a forcible blow. After that the Spaniard regarded itself as beaten, always fled at the approach of the large one, and let him alone. After that, too, it prepared to make its attacks and bitings on the smaller ones. Its bad character became the cause of its being given a privileged position. It was put in the cage only while the others were allowed to be at large. If it sees us playing with them, it comes and goes into its cage like a troubled soul, and vents its anger upon the trellis. It is exceedingly jealous, and its jealousy blinds it so much that it could not refrain from still taking its satisfaction out of the large one if it saw him running over me. The rest of the time it played freely, and did not abuse its liberty in any other way. It usually perches on its cage by the side of the chest furnished with rags, which serves as its sleeping-room. Toward three or four o'clock in the afternoon it regularly goes to bed, and comes from it habitually toward sunrise. Is not this a singular history; and does it not show that animals have passions, preferences, and antipathies, differences of character and changing moods which we have thought exclusively applied to men?

We now come to traits of intelligence. The cover of the Spanish lizard's chest slides. If it is pushed so as to leave a crack not large enough for him to go through, he works perseveringly, pushing his head into it till he has made it large enough. If the opening is too small for that, he scratches at it and makes a great noise with his paws, for the purpose, apparently, of making himself heard. In the same way sparrows knock on the windows of houses where they are accustomed to being fed. This reminds me of a story of a sparrow.

Several years ago I tamed one in the country. It was free in the

garden and came at my call. If I did not call, it came all the same. As I was accustomed to have hemp seed in my mouth, it would peck at me, picking my beard and mustache furiously till I had satisfied its appetite. It was satisfied that it had tamed me and made me its slave. My lizard is nearly in the same condition. It does not molest me, but when I take the box of worms it rises and snaps them from my hand and even from the box. It is well persuaded that man is the friend of the lizard. It has a delicate ear. When it is called from the end of the room, it turns its head to the right and the left, as if to get its bearings and find the direction whence the sound comes. It can hear the walk of an insect and a worm crawling on the ground. Its vision is likewise good, and it recognizes a meal-worm from a considerable distance.

The other lizards like their cage; and toward three or four o'clock in the afternoon they will all, if they are, for example, on the table, start to come down, using the chains to help their descent to the ground, and then climbing back into their abode and hiding by choice in their rag houses.

The Spaniard, notwithstanding his jealous, vindictive, and vengeful character, is more petted than the others, because we have him constantly in hand, and he is the easiest to take up and exhibit. For this reason too he is best at the little tricks we teach them. But, in view of the stupidity he manifested for several months, there is no doubt that the others, which, as I have said, with one exception became gentle and trustful in two or three days, if they had been the objects of the same careful attention, would have given still more marked proofs of capacity for education. If I turn the Spaniard on his back and make a sign to him with my finger, he will remain there for some time, but not without showing some impatience and raising his head. The animal is obedient to force, however mildly it may be exercised, but such obedience is a sign of reasoning.

It can not be denied that all its ways have a perceptible resemblance to those of the dog, particularly if we take into the account its poverty of means of expression. I saw in the London Zoölogical Gardens an Australian lizard, high on its legs, with the bearing and head of a greyhound, and very pleasant large eyes. I have forgotten its name. It impressed me as being easy to educate, so far as I could judge of lizards by the face. And what might we not get from large lizards if we should succeed in forming a domesticated race? We should not forget that my animals were captured adult. The conclusion of my long story is that the enormous intellectual differences which we usually assume as between reptiles and the highest mammals probably do not exist, and consequently that there is in the brain of reptiles sufficient avail-

able matter to permit them to adjust themselves to a certain degree of domesticity or to sociability; and it is the social state which, other things being equal, is the highest product of animal as well as of human intelligence.—*Translated for The Popular Science Monthly from the Revue Scientifique.*

SKETCH OF HENRY CARRINGTON BOLTON.

THE New York Academy of Sciences, founded in 1817 as the Lyceum of Natural History, is the oldest and most influential scientific society in the city. During a period of seventy-six years it has had but six presidents, viz.: Dr. Samuel L. Mitchill, who served seven years; Prof. John Torrey, four years; Major Joseph Delafield, thirty-eight years; Prof. Charles A. Joy, two years; Prof. John S. Newberry, twenty-four years; Prof. Oliver P. Hubbard, one year. At the annual election held February, 1893, Prof. Henry Carrington Bolton, Ph. D., was elected the seventh president.

HENRY CARRINGTON BOLTON was born in New York city, January 28, 1843, being the son of Jackson Bolton, M. D., and Anna Hinman, daughter of Elisha North, M. D., of New London, Conn. From both his paternal and maternal ancestors Dr. Bolton inherits traits that co-operate to give him scholarly tastes and stability of character.

The family of Bolton is among the few English ones able to show their descent from a period not far removed from the Conquest (1066). The extensive Yorkshire domain, from which the family derived its name, is mentioned in Domesday, and in 1135 Oughtrede de Bolton appears as Lord of Bolton and Bowbearer of Bowland Forest. From their estates in the charming Ribble Valley, near the southern border of Lancashire, the family spread through Yorkshire and adjoining counties, bestowing their name on many a dale and infant vill, so that to-day there are seventeen places in England known as Bolton, with or without distinguishing suffixes. From earliest times the Boltons were yeomen and tradesmen, but many of their sons entered the service of the Church, and not a few of them became eminent for scholarship.

In 1530 the direct ancestors of Dr. Bolton were living on an estate called Brookhouse, near the town of Blackburn, Lancashire, and from them he traces his descent without a missing link in the chain. In 1718 one of the family left England and settled in Philadelphia; his son and his grandson became prominent shipping merchants in Savannah, Ga., the latter taking into partnership his nephew Curtis, grandfather of the subject of this sketch.

Curtis Bolton subsequently removed to New York and became the head of the firm of Bolton, Fox and Livingston, owners of the Havre line of packets. Curtis married his cousin, Ann Bolton, daughter of Robert, of Savannah; their third son, Jackson, was graduated at Columbia College in 1833, and later at the University of Paris, where he received the degree of D. M. P. Dr. Jackson Bolton practiced his profession with success for over twenty years in New York city, and was also Vice-President of the New York Academy of Medicine and President of the Pathological Society.

That branch of the North family into which Dr. Jackson Bolton married had been residents of New England for two hundred years; the male ancestors of Dr. H. C. Bolton's mother for three generations had been physicians, the last in the line being Elish North, M. D., of Goshen, later of New London, Conn. Dr. North is remembered as among the first in America to practice vaccination, at Goshen, in 1800; as the first physician to open an eye infirmary in the United States; and as the author of works on Spotted Fever (New York, 1811) and on physiology, 1829.

Henry Carrington, the only child of Jackson and Anna H. Bolton, was born in his paternal grandfather's house, No. 58 Greenwich Street, New York city, at the date above given. The vicinity was the court end of the town, and the boy's earliest playground was the Battery. Later, his father moved up town, and the Battery was replaced by Union Square. Dr. Bolton's primary education was in private schools, and he has been heard to mention with deep gratitude the excellent training and kind consideration of Mr. George Stowe, who laid secure foundations in English studies. At the age of nineteen Dr. Bolton, in 1862, was graduated at Columbia College; he took no distinguished place in his class, but showed marked aptitude for mathematics, and for chemistry when the latter study was reached in the curriculum. Prof. Charles A. Joy, who held the chair of Chemistry at that time, had been prohibited by the trustees of Columbia from admitting students to practical work in the small laboratory adjoining the lecture-room, and Dr. Bolton was debarred from studying chemistry in a rational way; to supply this deficiency, however, his father provided him with simple apparatus and a few chemicals at home, where he attempted to apply the principles learned from the lectures of Prof. Joy. Very different from this the present methods at Columbia College.

Going to Europe immediately after graduation to continue his study of chemistry in foreign universities, young Bolton spent one year in Paris, first in the laboratory of the Sorbonne, then in charge of J. B. Dumas, and afterward in the laboratory of the École de Médecine under Adolphe Wurtz.

In 1863 to 1865 he continued his studies in Germany: at Heidel-

berg he worked in the university laboratory under the guidance of Bunsen, and attended lectures by Kirchhoff, Kopp, and Von Leonhard; during his sojourn in Heidelberg he took no part in the objectionable practices of the "Studenten-Corps," yet became so popular in the laboratory that at the beginning of the third semester he was elected by the students their "Polizei."

After a summer semester in Göttingen under Friedrich Wöhler, where he began research for a thesis, he went to Berlin, where he was admitted to the private laboratory of Prof. A. W. von Hofmann, the university laboratory not being as yet constructed. His position under Hofmann was a most agreeable one, and may be called that of pupil-assistant, as he worked at researches for Hofmann without any pecuniary compensation either to or from the university. For six months he was the sole pupil with Hofmann, but later he shared his table with the late Dr. Paul Mendelssohn-Bartholdy. In 1866 he took the degree of Doctor of Philosophy at Georgia Augusta University, Göttingen. Dr. Bolton's residence in Berlin was saddened by the death of his father, after a lingering illness, February, 1866.

During his five years' sojourn in Europe Dr. Bolton spent the long summer vacations in travel, chiefly in Switzerland and the Austrian Tyrol; he visited every canton in Switzerland on foot, and became an expert Alpine climber, ascending among other peaks the Titlis, the Col du Géant, the Cima di Jazzi, and Monte Rosa.

In the years 1866 and 1867 he made more extended journeys, traveling leisurely in Italy, Spain, France, Holland, Russia, and Scotland. In August, 1867, he returned to the United States, and, continuing his travels, went from Canada to Mexico. Settling in New York the following year, he opened a laboratory for private research, and eventually took a few pupils. In 1871 he spent five months in travel, visiting California and Washington Territory. In 1872 he was invited to the position of assistant in analytical chemistry at the School of Mines, Columbia College, under Prof. Charles F. Chandler. This position he accepted, and he had charge of the laboratory of quantitative analysis for five years, also giving lectures on the subject during the last year. Meanwhile, in 1875, he was elected to the chair of Chemistry in the Woman's Medical College of the New York Infirmary, of which Dr. Elizabeth Blackwell is dean; here he discharged his duties for three years, until he removed from New York city.

In 1877 he accepted the chair of Chemistry in Trinity College, Hartford, Conn., a position which he held for ten years. At Trinity he planned the interior of the chemical department and moved the apparatus and museum to the new buildings. He had marked influence in the organization of scientific courses, in which he had the co-operation of the late Prof. Louis M. Cheesman, who held

the chair of Physics at that time. As his duties in Trinity required him to teach mineralogy, he formed a collection of minerals, numbering about three thousand specimens, gathered largely by his individual exertions in the field.

As a teacher he strove to impart knowledge in an attractive way, believing that, by combining entertaining diversions with serious instruction, students would both comprehend and retain facts better than if presented in a dry, formal manner. Whenever it was possible he availed himself of object teaching; although he allowed in the class-room temporary displays of humor, his pupils understood that this was to be enjoyed and not abused, and always showed their teacher sincere respect. The experience gained in teaching analytical chemistry at the School of Mines he combined with the methods in vogue when he was called to the position of assistant, and the results he published in a volume entitled Student's Guide in Quantitative Analysis (New York, 1882; third edition, 1889).

In 1885 the President of the United States appointed him an assay commissioner.

While engaged in instruction Dr. Bolton carried on a number of original researches in chemistry, of which the more important are his investigations on the salts of the rare metal uranium, the results of which he published in several papers, 1866–'70. In 1872–'73 he assisted President Henry Morton, of the Stevens Institute of Technology, in researches on the fluorescent and absorption spectra of uranium salts, preparing a large number of compounds, including several new to science; the published results are in their joint names (American Chemist, 1873).

Between 1877 and 1882 he published three memoirs on the Application of Organic Acids to the Examination of Minerals (Annals of the New York Academy of Sciences), in which he showed the power of the organic acids in decomposing minerals, as well as their utility in determining varieties based upon definite reactions. He directed attention to the advantage of dry citric acid over the liquid mineral acids in geological field-work, owing to the perfect safety of transportation of the former. These methods have been incorporated in the last edition of Elderhorst's Manual of Blowpipe Analysis. The space at our disposal precludes mention of several minor original observations.

Dr. Bolton early in his studies felt the need of those important keys to knowledge, bibliographies, and has devoted much labor to the preparation of special and general works of this nature. His first effort in this direction was an Index to the Literature of Uranium, published in the Annals of the New York Lyceum of Natural History in 1870; this reached a second edition in 1885 (Smithsonian Annual Report), and has formed the model on which

a score of similar indexes to special topics have been produced. In 1876 he published an Index to the Literature of Manganese.

At the Montreal meeting of the American Association for the Advancement of Science (1882) he chose for his vice-presidential address the subject Chemical Literature, and suggested the formation of a committee on indexing chemical literature; as the chairman of this committee he has prepared ten annual reports to the association, and has done much to encourage the production of special chemical bibliographies by American chemists.

One of the most important bibliographical works by Dr. Bolton is his Catalogue of Scientific and Technical Periodicals, 1665–1882, published as vol. xxix of the Smithsonian Miscellaneous Collections in 1885. This comprises full titles of over five thousand scientific technical journals in about twenty languages, together with chronological tables showing the year of issue of each volume of five hundred periodicals, and a library check-list indicating in what American libraries sets of these journals are to be found. This undertaking was a labor of love on the part of Dr. Bolton, who, in the words of an eminent writer, acquired thereby "a place in the foremost rank of those little-appreciated and hard-worked men, bibliographers." Dr. Bolton has just completed a still more extensive work of a kindred nature, A Select Bibliography of Chemistry, 1492–1892. This general bibliography of chemical science comprises over twelve thousand titles in twenty-four languages, yet is a "select" catalogue, and makes no claim to completeness. The titles are arranged under seven groups, as follows: I, Bibliography; II, Dictionaries; III, History; IV, Biography; V, Chemistry, pure and applied; VI, Alchemy; VII, Periodicals. The volume contains 1212 pages, and forms No. xxxvi in the series of Smithsonian Miscellaneous Collections.

Parallel with his original researches and bibliographical compilations Dr. Bolton has given much attention to the history of chemistry, contributing many notes to current scientific journals, of which the following is a partial list:

Contributions to the History of Chemistry.—Historical Notes on the Defunct Elements, American Chemist, 1873. Views of the Founders of the Atomic Philosophy, American Chemist, 1873. Notes on the Early Literature of Chemistry, several papers in American Chemist, 1873–'79. Papyrus Ebers, the earliest medical work extant, Quarterly Journal of Science, London, 1876. Ancient Methods of Filtration, The Popular Science Monthly, 1879. Early Practice of Medicine by Women, The Popular Science Monthly, 1880. History of Chemical Notation (two papers), Transactions of the New York Academy of Sciences, 1883. Recent Progress in Chemistry, Transactions of the New York Academy of Sciences, 1886. The Lunar Society of Birmingham, Transactions of the

New York Academy of Sciences, 1888. The Likenesses of Joseph Priestley in Oil, Ink, Marble, and Metal, Transactions of the New York Academy of Sciences, 1888. The Contributions of Alchemy to Numismatics, American Journal of Numismatics, 1890. Progress of Chemistry as depicted in Apparatus and Laboratories, Transactions of the New York Academy of Sciences, 1893. An Account of the Progress of Chemistry for the Years 1882 to 1886, prepared annually for the Smithsonian Institution, 1882–'87. The last four contain bibliographies for their respective years.

Dr. Bolton's interest in the history of chemistry took practical shape in 1874, when he originated and organized the Centennial Celebration of the Discovery of Oxygen by Dr. Joseph Priestley, held August 1st at Northumberland, Pa.; on this occasion seventy chemists from all parts of the United States and Canada assembled around Priestley's grave to do him honor. The proceedings at this memorable gathering were printed in full in the American Chemist (1875). The acquaintances formed at this meeting with the descendants of Dr. Priestley were continued by Dr. Bolton, and through them he eventually secured a number of unpublished letters of the distinguished chemist; these letters he edited and published in a volume bearing the title: Scientific Correspondence of Joseph Priestley; New York, privately printed, 1892.

In 1882 a casual visit to the so-called "singing beach," at Manchester-by-the-Sea, Mass., made him acquainted with the peculiar natural phenomenon of musical sand, and, finding its study had been almost wholly neglected, he began an investigation which eventually led him to make journeys aggregating thirty-three thousand miles in search of sand having musical properties. Early in the research he secured the assistance of Dr. Alexis A. Julien, of Columbia College, to whose skill with the microscope he is greatly indebted. Jointly with Dr. Julien he has published several abstracts of papers on Musical Sand (Proceedings of the American Association for the Advancement of Science, and Transactions of the New York Academy of Sciences), which have been widely noticed in current literature.

The following papers, on topics of very wide range, can not be classified more narrowly.

Sundry Scientific and Literary.—Magic Squares, their History, Preparation and Properties (six papers), Acta Columbiana, 1874. The Log-book of the Savannah, Harper's Magazine, 1877. Legends of Sepulchral and Perpetual Lamps, Monthly Journal of Science, London, 1879. Microscopic Crystals in Vertebræ of Toads, Proceedings of the American Association for the Advancement of Science, 1880. A Handy Multiplication Table, American Teacher, 1885. The Life and Writings of Elisha North, M. D., Transactions of the Connecticut Medical Society, 1887. Scientific

Jottings on the Nile and in the Desert, Bulletin of the American Geographical Society, 1890. Historical Notes on the Gold-Cure, Popular Science Monthly, 1892. A Plea for a Library of Science in New York City, 1893. Russian Transliteration, American Library Journal, 1893.

In 1886 Dr. Bolton became interested in folk-lore, and published two years later a work bearing the title, Counting-out Rhymes of Children (London, 1888), which brought him at once into prominence as a folk-lorist. Since then he has contributed occasional papers to the Journal of American Folk Lore, of which the most notable are the two following: Some Hawaiian Pastimes (1891) and A Modern Oracle and its Prototypes (1893). His work on Counting-out Rhymes was awarded a bronze medal by the Columbian Historical Exposition held at Madrid in 1892.

After the death of his mother in 1887, Dr. Bolton resigned from Trinity College, retired from teaching, and resumed his residence in New York city. He has been able to indulge his love of travel by frequent journeys abroad; besides the five years' sojourn in Europe already named, he visited in 1873 the principal libraries of England, France, and Germany, to collect material for his Bibliography of Scientific Periodicals, the publication of which was, however, from various causes delayed until 1885. In 1880 he visited Norway, Sweden, and Denmark; in 1887 and 1888 he made a second and a third bibliographical tour in Europe; in 1889 he visited Egypt, going as far as Mount Sinai; in 1890 he visited the Bermudas and the Hawaiian Islands. These distant points were visited in search of "musical sand." In 1891 he again crossed the Atlantic, chiefly for research in libraries. Dr. Bolton has been heard to say he never travels to kill time or to satisfy mere curiosity; he always has some definite object in view and works harder on his journeys than otherwise.

Dr. Bolton is often called upon to give illustrated lectures on his travels and on popular science. Being an amateur photographer he brought back with him from Arabia Petræa and from the Hawaiian Islands many excellent negatives with which he illustrates his lectures. These include the following subjects: Four Weeks in the Desert of Sinai, Life and Scenes in the Hawaiian Islands, Picturesque Scenes in Norway, Alchemy the Cradle of Chemistry, The Counting-out Rhymes of Children, The Glaciers of Switzerland, Musical Sand, etc.

In 1892 he was elected by the Trustees of Columbian University Non-resident Professor of the History of Chemistry, and in the discharge of his duties gave in March, 1893, a course of nine lectures on the history of chemistry. He treats this subject in a graphic way, making it attractive to the general audience by illustrating every step with the lantern.

Dr. Bolton joined the Lyceum of Natural History of New York City in 1867 and has been an active member for twenty-six years. He was one of the committee (with the late Dr. John S. Newberry and Prof. B. N. Martin) who accomplished in 1876 the change of name to the New York Academy of Sciences by which it is now known; from 1876 to 1877 he held the office of corresponding secretary; from 1887 to 1892, of recording secretary; from 1892 to 1893, vice-president; and in 1893 president. He has also been prominent in the national society, the American Association for the Advancement of Science, frequently serving on its council and on committees, besides holding the office of Secretary of the Chemical Section (1876), Secretary of the Council (1889), general secretary (in 1878, 1879, and 1890), and vice-president (1882). Dr. Bolton was one of the founders of the American Folk-lore Society in 1887, and has been on the council of the society to date. He is also president of the New York branch of the American Folk-lore Society established in the spring of 1893. He has been a member of the Executive Committee of the New York Section of the American Chemical Society since its foundation.

To all these societies Dr. Bolton has frequently contributed papers; including communications of literary and general character printed in journals, they number more than a hundred and fifty. He has been influential in shaping the policy of the Council of the Scientific Alliance of New York City, and was made its treasurer in 1893.

Dr. Bolton is a member of many learned societies besides those above named, the chief being as follows: German Chemical Society of Berlin, Chemical Society of Paris, National Society of Natural and Mathematical Sciences of Cherbourg, American Society of Naturalists, Numismatic and Antiquarian Society of Philadelphia, American Metrological Society, Brooklyn Institute, corresponding member of the Rochester Academy of Sciences, and honorary member of the Elisha Mitchell Scientific Society of Chapel Hill, N. C.

He founded the 'Ology Club in Hartford and the Lunar Society in New York, social clubs for scientific discussions and mutual admiration. He is a member of the University Club of New York and of the Cosmos Club of Washington.

Dr. Bolton's private library, though numbering less than one thousand volumes, is probably unique in the United States, being devoted to the history of chemistry. It is rich in original works on alchemy and early chemistry, besides containing a collection of several hundred portraits of scientists of all countries and all time. At the request of the Grolier Club of New York city, he made an exhibit of a selection from his library in their club house in January, 1891.

CORRESPONDENCE.

MAJOR POWELL ON "ARE THERE EVIDENCES OF MAN IN THE GLACIAL GRAVELS?"

Editor Popular Science Monthly.

SIR: The article by Major Powell, which appeared in your July number, calls for a few words of comment. It was written apparently as an indirect reply to our own paper in the April issue. But it contains little more than a restatement of some elementary truths in geology, which, however new they may be made to appear by the art of the writer, are really somewhat ancient, and form a part of the stock of every tyro in the science.

To this, however, no one can properly object. Major Powell is entitled to write whatever he chooses. But bad logic and misrepresentation of authorities are not legitimate argument, and in a few points where the distinguished head of the United States Geological Survey touches upon topics which we referred to in the former article we may be allowed to criticise his statements.

In the first place, the major is in error in misconstruing our words into an attack on the United States Geological Survey. No fair construction of the language will support this charge. Our chief purpose was to expose and condemn the tone and spirit of the reviewers whose assaults we criticised, and especially the language in which one of them had seen fit to express his opinions. For this latter words too strong could hardly be found. What sentiments have been awakened by it in the minds of geologists, both in America and abroad, we can imagine. They must be both amused and amazed to see a member of the Geological Survey of a great and enlightened country so far forgetting the dignity and responsibility of his office as to indulge in invective and vituperation against a fellow-worker in the scientific field.*

Major Powell's paper is in striking contrast to that of his subordinate in being perfectly courteous. We could expect nothing else from him. Had all the critics of Prof. Wright been equally dignified and gentlemanly there would have been no ground for objection.

We confess, however, to a feeling of regret that the director stopped short of any remark indicating disapproval of the language that had been used by a member of his staff. We can not bring ourselves to believe that he sanctions it, but his silence lends it at least an indirect support. We think that a word of this kind would have done the Survey a greater service than any attempt to defend it where it was not attacked, or any discourse on the harmony and courtesy which have, he tells us, characterized its discussions up to date.

Major Powell makes but little direct allusion to us, though his paper was evidently called out by our article. He contents himself with the general assertion, or rather implication, that "every paragraph is based on error." Such sweeping charges are easily made, and are often as erroneous as easy. Not a single error is adduced, and the inference from this omission is not difficult. At all events, it will be soon enough to defend the paragraphs when they are definitely attacked.

Meanwhile, we propose to investigate a few passages of Major Powell's article, in order to see if the critic is himself above reproach, and to discover if any erroneousness lurks concealed within his own paragraphs. Space will not allow more than this. But unless his arguments are better than those of his comrades and subordinates, he will be but a poor ally to aid them in their cause.

Major Powell refers to the Nampa image. Now, it was and is no part of our plan to defend this "find." It is no bantling of ours. We leave it to the tender mercies of others more competent. We merely pointed out in the former paper the fallacy of the arguments used by the writer to whom we referred in his attack upon it and on Prof. Wright. Though Major Powell has failed, probably for the very best of reasons, to give the exact details for which we called, yet his words sufficiently prove the inacuracy of the story, as given in the American Archæologist and in the Literary Northwest. It is a pity also that Major Powell has allowed himself to misrepresent the evidence for want of reference to the original documents in the Proceedings of the Boston Society of Natural History. His language leads the reader to infer that he was not even aware of their existence, inasmuch as he says that his greatest surprise on reading Prof. Wright's second book was to find that the image had fallen into his hands and was used as an argument in favor of the antiquity of man. This was two years after the original publication by Prof. Wright, and his arguments were by this time familiar to all students of American archæology.

* It is deeply to be regretted that this same official has seen fit to repeat and thus to exaggerate his offense by putting out, since our article was written, a second paper of similar tenor. Though a copy of this was in our possession at the time of writing, we could not justly refer to it, as it had not then appeared. We also hoped that the author's good sense would lead him to acquiesce in its suppression for the sake of American science and his own reputation. This hope was, however, disappointed.

But let this pass. Major Powell writes on another page of a human skeleton alleged to have been found in a bluff excavated by the Mississippi River in the loess that borders its channel. He says:

"The loess is a formation contemporaneous with the glacial formation of the north. The discovery of a human skeleton in this situation was believed to prove that man dwelt in the valley of the Mississippi during the loess-forming period. The discovery seemed of so much importance that the site was visited by Sir C. Lyell, who, on examination, at once affirmed that the skeleton was not found in the loess itself, but in the 'overplacement,' or modified loess—that is, in the talus of the bluff—and all geologists and archæologists have accepted the decision."

We fear that this circumstantial story on examination will prove to be similar to some other evidence that has been brought forward in the current discussion, and it is with no little surprise that we see so prominent a geologist advancing arguments so weak and testimony so garbled. But we will for a moment waive this objection. Assuming that Sir C. Lyell did express the opinion here maintained by Major Powell, we may be allowed respectfully to remark in passing that if that geologist was able so easily and so long ago as 1846 to distinguish between the bluff and the "overplacement," it is a little late to claim the criteria of this distinction as a discovery of any geologist or any body of geologists in the present day. This is a discovery of the already discovered, an appropriation of the "finds" of other men, equal to any of the wonderful deeds related in the travels of the renowned Captain Brazier. Sir Charles must have been born too soon—at least forty years ahead of his time. The geological world of America has only just come up to him.

But returning to our main line, we can not even at this point allow Major Powell's argument to rest. A regard for logic compels us to tax him with carelessness and inaccuracy, if not with misrepresentation, in his references to Sir Charles Lyell. He refers as above to that author's Second Visit to the United States. How correctly this is done a comparison of his words with the following extracts will show.

Lyell writes, in the Antiquity of Man (p. 203):

"Mingled with the bones of mastodon, megalonyx, equus, and others, the pelvic bone of a man was obtained. It appeared to be in the same state of preservation and was of the same black color as the others, and was believed to have come like them from a depth of about thirty feet from the surface."

"In my Second Visit to America in 1846 I suggested, as a possible explanation of this association of a human bone with remains of a mastodon and megalonyx, that the former may possibly have been derived from the vegetable soil at the top of the cliff, whereas the remains of the extinct mammalia were dislodged from a lower position, and both may have fallen into the same heap or talus at the bottom of the ravine. Had the bone belonged to any recent mammifer other than man, such a theory would never have been resorted to."

Lyell's very words in the original work read thus: "I could not ascertain that the human pelvis had been actually dug out in the presence of a geologist or any practiced observer, and its position unequivocally ascertained. Like most of the other fossils, it was, I believe, picked up in the bed of the stream, which would simply imply that it had been washed out of the cliffs. But the evidence of the antiquity of the bone depends entirely on the part of the precipice from which it was derived. It was stained black, as if buried in a peaty or vegetable soil, and may have been dislodged from some old Indian grave near its top, in which case it may have been only five, ten, or twenty centuries old; whereas if it was really found *in situ* at the base of the precipice, its age would more probably exceed a hundred thousand years." —(Second Visit, chap. xxxi.)

The wide discrepancy between the language of Lyell and its interpretation by Major Powell is obvious. There is absolutely no justification for the assertion that Lyell "at once assigned the bone to the talus." He evidently resorted to this possible explanation to avoid what was in 1846 a yet more formidable difficulty—the admission of the great antiquity of man. Lyell's so-called evidence must therefore be thrown out of court. His decision on the point is purely fictitious, and the statement that "all geologists and archæologists have accepted it" is merely a fiction based on a fiction.

But the criticism must not in justice end even here. It is not fair in so rapidly advancing a science as geology to quote the words even of a leader published nearly fifty years ago, without any intimation that he afterward changed his opinion. Lyell was a man who grew with the times in which he lived. The palæoliths from the gravels at Amiens were cardinal evidence to him, and supported as they then were by similar though less conclusive testimony from other places, they worked his conversion to the doctrine of the great antiquity of the human race, a belief in which he never afterward wavered. His belief found a place in his writings. He revised or even recanted his former opinions wherever he thought them erroneous, and his great work, The Antiquity of Man, is at once a monument of his candor and of his progress. Had Major Powell taken the trouble to consult this volume, with which we must suppose that he is familiar, he would scarcely have dared so completely to misrepresent its author as he has done. He has laid himself open to at least

the charge of gross carelessness in citation of testimony, and his paragraph is "manifestly founded on errors" for which it is hard to find any plausible excuse.

Lyell writes in the chapter already quoted, when referring to this fossil (which, by the way, was not, as Major Powell says, a human skeleton, but merely a broken pelvic bone):

"After visiting the spot in 1846, I described the geological position of the bones and discussed their probable age with a stronger bias, I must confess, to the antecedent improbability of the contemporaneous entombment of man and the mastodon than any geologist would now be justified in entertaining" (p. 200). "My reluctance in 1846 to regard the fossil human bone as of post-pliocene date arose in part from the reflection that the ancient loess of Natchez is anterior in time to the whole modern delta of the Mississippi . . . . If I was right in calculating that this delta has required more than one hundred thousand years for its growth, it would follow, if the claims of the Natchez man to have coexisted with the mastodon are admitted, that North America was peopled more than a thousand centuries ago by the human race. But even were that true we could not presume, reasoning from ascertained geological data, that the Natchez bone was anterior in date to the antique flint hatchets of St. Acheul . . . . Changes of level as great as that here implied have actually occurred in Europe during the human epoch, and may therefore have happened in America . . . . Should future researches, therefore, confirm the opinion that the Natchez man coexisted with the mastodon, it would not enhance the value of the geological evidence in favor of man's antiquity, but merely render the delta of the Mississippi available as a chronometer."

The principles of exegesis which allow the extraction from these words of an affirmation that the bone was not found in the loess but in the "overplacement" are decidedly original and may be valuable in a case of urgent need. They recall to one's mind Prof. Huxley's satire on the Hebrew language. A case that stands in need of logic so bad and of quotation so erroneous must indeed be in a sorry plight. Sir C. Lyell evidently had no intention of denying the antiquity of the human pelvis. With characteristic caution he suspended judgment, and no one has any right to wrest his language in either direction. Whether ancient or not ancient, whether fraud or forgery or fact, matters not here. Testimony has been misquoted and authority misapplied. We plead not here for the genuineness or antiquity of the Mississippi man, but for fairness in logic and accuracy in statement.

We can not avoid the impression that in another place Major Powell somewhat transgresses the limits of accuracy where he says:

"Prof. Wright stands almost alone in his advocacy of a scientific doctrine. He has a few sympathizers and some defenders of some portions of his theory, but the great body of his work is repudiated by nearly every geologist in America and especially by the professorial corps."

The latter part of this extract may be true, but so far as they have declared themselves the following may rightly be claimed on his side: Dana, Hitchcock, Emerson, Crosby, Upham, and Bell. Others, in view of the pending discussion, await further evidence. Abroad a longer list of names may be drawn up, including that of the venerable Prestwich, ex-Professor of Geology at Oxford, Hughes, of Cambridge, Lamplugh, Crosskey, Kendall, and Dugald Bell in Great Britain, Falsan in France, Credner and Diener in Germany, Holst of Sweden, and Nitikin, state geologist of Russia. Sir H. H. Howorth says in a recent work,* "While the theory of a plurality of glacial periods has found several advocates in Germany, the French geologists are virtually unanimous on the other side." With such a list Prof. Wright stands "alone" in good company.

The scientific imagination is a faculty of the highest order and of great value so long as it is held in check by reason and knowledge. But when Pegasus runs or flies away with his rider, the result is often disastrous to the latter. We have already given proof of Major Powell's great command over the realm of fiction. He will excuse us if we further illustrate his supremacy in this region by another equally striking quotation. Writing of the so-called palæolithic implements recently found in New Jersey and some other places in the Eastern States, he says:

"These implements were gathered in very great numbers and collected in various museums in the United States and many collections were sent abroad to the great museums of the world. Several different collectors were engaged in this enterprise for some years and acquired great reputation for their proof of the antiquity of man on this continent and for their zeal in discovering the evidence, and to recompense them for this work they were made members of many scientific societies throughout the world and decorated with ribbons, and some were knighted."

We took the liberty in our last paper of calling indirectly on Major Powell for exact details regarding the Nampa image, but without very great success. Will he allow us respectfully to ask for some further particulars concerning this very startling paragraph of his, in order to remove the suspicion that spontaneously but irresistibly lurks in our mind that it too is "based on error"? It would be deeply interesting to the archæologists of this country and of others to learn where are the "very great numbers" of these palæoliths from New Jersey, in what "museums of the United States" they are stored, and to what "foreign institutions

* The Glacial Nightmare and the Flood, p. 469.

many collections have been sent." We should also like to know how many of these collectors "have been made members of many scientific societies," how many have "been decorated with ribbons," and the color, style, and significance of these same ribbons. But especially would it delight the archæological world to be favored with a list of the Sir Knights who have received the accolade as a reward of their great powers and magnificent achievements on the hard-fought field of American archæology, and who are now Sir Somebody Something and Sir Something Somebody among their untitled scientific brethren of this democratic land. We are free to confess that in our seclusion in "Ohio" we had not heard of these decorations, and did not know that the palæolithic heretics had amassed so much evidence in favor of their great archetype in America, or that they had been so highly and so widely honored for their discoveries. We must infer, though we had not heard of the fact, that our palæolithic acquaintance, Dr. Abbott, is now Sir C. C. Abbott, of Trenton, N. J., and Bristol, Pa. We congratulate him. Others will no doubt be heard from in due time.

We sincerely trust that the Director of the United States Geological Survey has not been in this instance also drawing on his imagination and clothing the creations of his fancy with "local habitations and names." But if not, we must express the fear that he has been looking at the palæoliths and their finders through his most powerful multiplying glass.

We write the above criticisms not without regret. Major Powell's services to geology as the head of the United States Geological Survey have been great. Not even himself will claim that they have been faultless. But in entering the controversial field it is needful first to make quite sure of the facts and then to reason logically from them. In the former respect some of Major Powell's paragraphs are "based on error," as we have shown, and his deductions from them are consequently mere fallacies. If no stronger argument can be found, the case for which he has pleaded may almost as well be abandoned.

In the midst of so much that is open to criticism it is refreshing and pleasing to find Major Powell expressing a sentiment with which all geologists and other scientists should agree and with which we ourselves are in full accord. We thank him for so well wording what must be the rule of all concerned who appreciate the present position of the palæolithic discussion in this country. He writes:

"We will all withhold final judgment until the evidence is in, being perfectly willing to believe in Glacial man or Tertiary man or Cretaceous man if the evidence demands it, and being just as willing too to believe that man was introduced on this continent within the last two thousand years if the evidence demands it. What care we what the truth is if it is the truth?"

Grant this, and courtesy in debate, and the present controversy will not have been useless. E. W. CLAYPOLE.

AKRON, OHIO, *June* 29, 1893.

EDITOR'S TABLE.

CIVIC DUTY.

AMONG the hopeful signs of the times we may reckon the increased attention that is being given in our higher schools to the study of "civics," a term which includes the general principles of government, the Constitution of our own country in particular, and the duties of citizenship. It is somewhat extraordinary that the importance of instructing our youth in these subjects was not earlier recognized; but we may hope that, now that they have been introduced pretty generally into our educational courses, they will assume the prominence to which they are entitled. If the State undertakes to educate, it should be mainly and primarily with a view to producing good citizens; and the instruction which specially pertains to this object should in all public schools have an honored, if not indeed the foremost, place.

What is government? is a question which must spontaneously occur to the mind of every young person, and the teacher is fortunate who has a subject to deal with in regard to which his or her pupils are already prepared to ask questions. Government, it can be explained, in the first place is control. Control may be exercised either for good or for evil—either in excess of requirements, or in due proportion to

requirements, or in measure inadequate to requirements. Control exercised for evil is tyranny, and should, wherever possible, be res sted; control exercised for good is government in the best sense and deserves loyal acquiescence and support. Control in excess of requirements again is tyranny, even though exercised not by a monarch but by a majority of the citizens; control in due proportion to requirements is government in a good sense; control inadequate to requirements means a greater or less degree of anarchy. It should not be difficult to interest the minds of the young in deciding or trying to decide for themselves certain practical questions to which these definitions would naturally give rise. Take the government of a given country at a given time: was it tyrannical or was it reasonable government? Did it deserve resistance or support? Such and such laws, are they in excess of requirements, or are they such as circumstances demand? What are we to understand by "requirements"? Requirements for what? Here is the opportunity for pointing out how purely meddlesome and intrusive a great deal of legislation is—the mere mandates of majorities who want to have their way in everything, and are not content to win others over by persuasion, but insist on forcing them into conformity by legal measures. The "requirements" it can be shown, beyond which political control should not go, are the requirements of national cohesion. Whatever tends to enforce uniformity of practice or habit or opinion beyond the demands of national unity partakes of the nature of tyranny, whether the authority that imposes it has one head or a million heads. The necessity for government in the true sense can be made evident to the weakest understanding, and from this will obviously flow the duty of every citizen to aid in the maintenance of law and order. What kind of a society, it may be asked, would that be the sole foundations of which were force and fraud? What would become of human industry if the laborer could not depend on receiving his honest wages, or any worker on protection in carrying on his employment? Law, it will be seen, is no restraint upon the good, but is their shield against the aggressions of the evil; to the latter alone is it a terror, and they alone can have any interest in weakening its authority. Yet even they would suffer were there no law, and consequently the ideal condition of things for a bad man would be one in which others obeyed the law while he succeeded in evading it. The habitual criminal is thus no better than a beast of prey or a parasite.

Teaching of this nature addressed to a class in which some kind of public opinion was capable of being evoked would, we are persuaded, do much to create in the minds of the young a sense of the interest they have in upholding the institutions of the country, both national and municipal. We incline to the opinion that this interest should first be awakened by means of general considerations upon government before detailed instruction is given in the national Constitution. When the time has come for the latter, the different purposes which each power in the State is intended to serve should be carefully explained, and the pupils should be invited to exercise their own independent judgment upon the Constitution as a whole and upon its several parts. They might be freely asked whether they could suggest anything better, and the whole subject should be commended to them as one in which they have an interest that can not safely be neglected. It should be impressed upon them that, if honest people do not take an interest in politics, dishonest people are sure to do so, and that the only way to nullify the influence of the bad is for the good—those who have the welfare of their country at heart—to occupy the field in overwhelming numbers themselves.

Modern writers note a decline in the sentiment of patriotism; but we can afford to let the old patriotism go, if we can get a better patriotism in its place. The old patriotism involved hardly less of hostility and ill-will to other countries than of attachment to one's own. The new patriotism calls upon us to serve our own country first, and no less in peace than in war, but to be desirous that other countries should be equally well served by their sons. The old patriotism formed easy alliances with selfish and unworthy interests, so that the trade of patriot became one of the most suspected of vocations—so much so that the sturdy old Tory, Dr. Johnson, denounced it as "the last refuge of a scoundrel"; but the new patriotism which can not commend itself by loud-mouthed denunciation of other countries can only make itself known and felt by useful activity in the public interest at home.

The complete instruction of our youth in civics will have to embrace, we regret to say, a description of the principal evils which dog the steps of representative government. We have just glanced at the evil of indifference in political affairs, but in a course of instruction it would merit much fuller treatment. Then there is the opposite evil of excessive partisanship leading to the gravest abuses of administration, and through the frauds which it introduces into the working of the political machine threatening even the stability of the State. There is the evil of excessive taxation, resorted to in order that the party in power may have more money to distribute for political purposes. There is the evil of corrupt understanding between the party in power and business men whose pecuniary interests that party can promote by legislation—so much tariff (for example) meaning so much money to be contributed at election times. The celebrated letter in which the chairman of a certain committee threatened to "fry the fat" out of certain manufacturers who, after having been put in the way of enriching themselves at the expense of the public, had failed to respond with due liberality and gratitude when the hat was being passed round for a great political campaign, should be printed for an everlasting remembrance and illustration of "how it works." As regards the thieves and pirates who obtain government contracts and enrich themselves by furnishing inferior articles, it would be easy to rouse against them the fierce indignation and reprobation of any class of ingenuous youths; and it would not be hard to show that many other frauds upon the Government, such as charging undue prices for things, obtaining by collusion contracts at figures beyond what would afford a fair profit, and so on, are all of an infamous nature and utterly unworthy of any man pretending to be a good citizen. Great care should be taken not to deal with any of these subjects in a cynical spirit or to create the impression that the evils indicated are more widespread than they really are. It ought to be a paramount object to promote respect for the country in which we live, and while the evils and dangers which beset our system of government should be plainly pointed out, stress should also be laid upon the vast amount of faithful service and unselfish devotion which the country receives from its worthier sons. The spirit to cultivate is not one of despondency, but one of hope, of confidence, and of resolute endeavor. Let our young people but have the right kind of teaching, and they will respond to it, and in less than ten years the effect for good upon the public opinion and public life of the country will be very apparent.

LITERARY NOTICES.

VERTEBRATE EMBRYOLOGY. A TEXT-BOOK FOR STUDENTS AND PRACTITIONERS. By A. MILNES MARSHALL, M. D., D. Sc., Professor in the Victoria University, etc. New York: G. P. Putnam's Sons. London: Smith, Elder & Co., 1893. Price, $6.

As the author truly states in his preface, most of the text-books of embryology aim rather at explaining the general progress of development within the several animal groups than at supplying complete descriptions of individual examples. Thus there have been no reasonably complete accounts of the development of the common frog or of the rabbit, while in human embryology so much is yet unknown that the descriptions and figures given in illustration of them are those of embryonic rabbits, pigs, chickens, or dogfish. As the results of recent investigations have shown that marked differences, both in the earlier and the later stages of development, may occur between allied genera and species, it may be perceived that this practice of illustrating human embryology by embryological types selected from the lower animals may be the cause of much confusion.

In preparing this volume the author has selected a few types to each of which a separate chapter is devoted. The first chapter gives a general account of the development of animals, including the structure, maturation, and fertilization of the egg, and a description of the early stages of the development of the embryo. We think the author has made a slight *lapsus calami* in the statement on page 13 that "after one spermatozoon has entered an egg others seem incapable of making their way in"; we judge that he intended to write "yolk" instead of egg, for spermatozoa have been found not only in the zona but in the perivitelline space. We believe that it is after the spermatozoon gains entrance into the yolk instead of the egg, as is stated, that the tail is lost. The theory of sex is too meagerly presented to afford the student any enlightenment, none of the more important theories being mentioned.

The second chapter is devoted to the amphioxus, giving a general account of the early and late embryonic development of this fish-like animal. In this chapter the author has followed the descriptions of Kowalevsky, Hatschek, Lankester, and Willey; and this animal has been selected as an introduction to vertebrate embryology because of the simplicity of its earlier developmental history as well as on account of the clew that this affords to the more complicated conditions occurring in the higher vertebrates.

The third chapter gives a general account of the development of the frog, the description of the processes of maturation and fertilization of the egg being based on O. Schultze's investigations, while the account of the early stages of development of the nervous, circulatory, digestive, and reproductive organs is based on the observations of the author and his pupils.

The fourth chapter gives a description of the development of the chick that is so familiar from the accounts given in most of the physiologies.

The fifth chapter gives an account of the development of the rabbit, the author following the accounts of Van Beneden, Kölliker, and Duval in his description of the processes of segmentation of the egg, of the formation of the blastodermic vesicle, and of the placenta. The descriptions of the later stages of development are based on his own observations.

The sixth and final chapter describes the development of the human embryo, and is, of course, to a large extent, based on the researches of His.

The author requests that human embryos of any age, but more particularly those of the first month or six weeks, be wrapped in cotton, placed in a bottle of strong alcohol, and sent to him at Owens College.

We note, especially in the earlier part of the book, a duplication of illustrations: thus Figures 1 and 45; 2 and 14; 3 and 46, 47, 48, 49, and 50; 4 and 97; 5 and 102; 6 and 103; 7 and 105; 8 and 25; and 9 and 26, are identical.

The book is clearly written in English rather than Anglicized German, and there is a most agreeable omission of German terms that mar the harmony of some of the recent works on embryology. Long quotations and discussions of mooted points are avoided, the author apparently seeking to present that

that will facilitate the work of the student. We believe that the volume will become a popular text-book on the subject.

A HISTORY OF CRUSTACEA. RECENT MALACOSTRACA. By Rev. THOMAS R. R. STEBBING, M. A. With Numerous Illustrations. New York: D. Appleton & Co., 1893. Pp. 466. Price, $2. Being No. 71 of the International Scientific Series.

IN the preface to this work the author says that his ambition was to prepare a volume "to which beginners in the subject will have recourse, and one which experienced observers may willingly keep at hand for refreshment of the memory and ready reference." He has succeeded eminently well in carrying out that project; for, besides giving the classification, physiology, habits, and description of some thousands of crustacea, Mr. Stebbing has added several new species to the already voluminous list of crustaceans, and made interesting reading of what students and beginners so often find dreary and unentertaining.

The chapter entitled "Specimens" contains some very useful information on the collection of crustacea for examination, and the author rather humorously points out that even at the breakfast table examples of three very distinct orders can be obtained "in a dishful of prawns." In the same chapter he explains the best methods of capturing crustacea, and tells of some new genera which are found at the enormous depth of three thousand and fifty feet.

The chapters on the various tribes, legions, and families of the suborders *Macrura* and *Brachyura*, which contain among them the edible crab, lobster, shrimp, etc., are full of interesting and valuable information, and the author has in many instances corrected the errors of former natural historians who named certain members of the smaller crustaceans before they had properly developed from the larval stage. Mr. Stebbing also bemoans "the hard fate of natural historians," particularly beginners, for he says that the confusion of names would sometimes deter a timid person from pursuing the study. He believes in the simplest possible nomenclature, and he has himself endeavored to simplify his work by making it easily understood by those who are inexperienced. The chapters on the habits of the cocoanut crab (*Birgos*) and of the various kinds of land crabs will be read with very great interest by all classes of people, apart from those who are engaged in the study of the crustacea. As a matter of fact, the entertaining manner in which the author tells of the curious habits of these most curious animals, of their strangely developed instincts, and of their general modes of living, makes more interesting reading than is generally found in such exhaustive scientific works.

The vexed question of the position and existence of eyes in some of the crustaceans is finally set at rest in this work. Mr. Stebbing also proves beyond question that the crab uses the bases of his walking legs as mandibles—a fact which has heretofore been accepted only in theory by a few scientists. In describing the latter peculiarity of the edible and other species of crab, the author humorously remarks that, although it may seem as strange for a crab to use his feet for the purpose of mastication as it would be for a human being to have his teeth upon his elbow for a similar purpose, it is nevertheless a fact indisputably proved. Over three thousand species of crustaceans are defined in this volume, which can not fail to interest the general reader, as well as being of much importance to the student and as a book of reference.

ELECTRICITY AND MAGNETISM. By EDWIN J. HOUSTON. Pp. 306.—ELECTRICAL MEASUREMENTS. By EDWIN J. HOUSTON. Pp. 429. Price, $1. New York: The W. J. Johnston Co., 1893.

THERE are already so many elementary books on electrical subjects, addressed either to the student or the general public, that a new book must needs have distinctive merit to justify its publication. This is possessed in an eminent degree by the above collection of primers from the pen of Prof. Houston. He has the gift of lucid exposition, and is, moreover, thoroughly familiar with his subject. Not the least of the merit of his exposition is his interpretation of the phenomena in the light of more recent electric theory, which has undergone marked changes in the past few years. Each book consists of a collection of chapters complete in itself, which the author terms a primer, the closing chapter being a brief review of all the oth-

ers, and termed a primer of primers. A feature of the work is the appending to each primer of one or more extracts from current electrical works on the subject matter of the primer.

In electricity and magnetism the author deals with the sources and phenomena of static and current electricity and magnetism. His statement of the theories of magnetism is a particularly clear and concise summing up of the present views of the subject, and it is to be regretted that he did not undertake to do the same with the theories of the electric current. In the primer on atmospheric electricity our quite limited knowledge of the subject is presented concisely, though it is to be noted that the author follows the accepted views of lightning protection, and gives no hint of the recent important experiments and theories of Prof. Lodge on this subject.

The second of the books takes its name from the first three primers, which are devoted to the measurement of electric currents, electro-motive force and resistance, and are concerned with an account of how these measurements are made.

The voltaic cell forms the subject of one primer, and thermo-electric batteries of another. The distribution of electricity by continuous currents and the arc and the incandescent light are considered in three primers. In the primer devoted to the alternating current a brief account is given of the modern theory of such a current; and in a primer on alternating currents of high frequency there is an excellent summary of the remarkable experiments of Tesla with such currents. A primer is devoted to induction coils and transformers, one to dynamos, another to the electric motor, and another to the electric transmission of power. Other primers are on electro-dynamics, electro-dynamic induction, and alternating current distribution. The books are printed on good paper, in clear type, and are of convenient size.

ORIGINAL PAPERS ON DYNAMO MACHINERY AND ALLIED SUBJECTS. By JOHN HOPKINSON, F. R. S. New York: The W. J. Johnston Co., 1893. Pp. 249. Price, $4.

THE researches of Dr. Hopkinson on electro-technical subjects, more especially those upon the dynamo, have long been recognized as of the highest importance, both for their theoretical interest and for their value in the bearing they have upon the work of the practical constructor. The papers in which these researches have been described have heretofore been accessible only in the proceedings of scientific societies and in the technical journals, and are now for the first time collected in the present volume. The collection consists of eleven papers, five of which are devoted to the dynamo, in which are developed the theory and use of what has come to be known as the "characteristic curve of the dynamo." This curve expresses the relation between the current and electro-motive force of a dynamo at a given speed—the horizontal distances or abscissas representing the amount of current, and the ordinates the electro-motive forces—and in the hands of Dr. Hopkinson has been found capable of giving a solution to all the complicated questions of practical dynamo construction. Other papers are: Some Points in Electric Lighting, the Theory of Alternating Currents, the Theory of the Alternate-Current Dynamos, and a report upon the Westinghouse transformers. In the first of these a very interesting mechanical illustration is given of the facts of electrical induction by means of a model, first suggested by the late Prof. Clerk Maxwell, and in the second the proper method of coupling up alternating dynamos in a supply circuit is pointed out, and the conditions for the most efficient action determined. Alike to the student and the practical dynamo designer these papers will prove of the greatest value, and will form a desirable if not essential addition to his technical library.

IDLE DAYS IN PATAGONIA. By W. H. HUDSON. New York: D. Appleton & Co. Pp. 256. Price, $4.

THE author of The Naturalist in La Plata gives us in this volume some further account of his wanderings in South America. He calls himself an "idler" here, being made such by an accidental pistol-shot which kept him for some time from active exploration. Yet, though unable to go far afield, Mr. Hudson gathered many curious observations and much store of entertaining anecdote during his idle days. The reader will learn from these chapters that Patagonia is not

wholly a wild, inhospitable tract, inhabited by wandering savages, but that the northern part, at least, is a grazing country, with settlements and white inhabitants, much like the adjoining districts of the Argentine Republic. He will learn also something about the natural products of the land, its climate, life among the settlers, the Indians, the wild animals, and most of all, for the author is an ornithologist, about the birds. In the cultivated valley of the Rio Negro there are birds in plenty—mocking-birds, several varieties of finches, wood-hewers, swallows, and among larger fowls the upland geese, owls, vultures, condors, ostriches, swans, and flamingoes. Mr. Hudson does not write like a teacher nor like a restless searcher after discoveries, but rather like one telling of a pleasant vacation; hence it is safe to predict for him many delighted readers. The book has been fully and pleasingly illustrated by Alfred Hartley and J. Smit.

EVOLUTION AND MAN'S PLACE IN NATURE. By HENRY CALDERWOOD, LL. D., F. R. S. E., Professor of Moral Philosophy, University of Edinburgh. New York and London: Macmillan & Co., 1893. Pp. 349. Price, $2.

IN the opening chapter of this work Prof. Calderwood says that "the general acceptance of Darwin's theory of evolution gives force to the demand for discussion of this problem." The author uses the sentence just quoted as a reason for writing the book. He accentuates that sentence by stating, on page 2, that "whatever limitations are to be assigned to the theory, we must at least grant that a law of evolution has had continual application in the world's history"; and he adds that in the matter of elucidating the phenomena "the researches of Charles Darwin and Alfred Russel Wallace have led the way."

It is not easy to understand how such a man as Prof. Calderwood could have fallen into the too common error of attributing priority to Darwin in connection with the doctrine of evolution. Herbert Spencer published his essay on the Development Hypothesis in 1852; in 1855 the Principles of Psychology, an application of the doctrine of evolution to mental phenomena, followed from the same pen; and, finally, in 1857, or two years before the appearance of Darwin's Origin of Species, Mr. Spencer published Progress: its Law and Causes, which was devoted to the discussion of *universal evolution*.

Nevertheless, Prof. Calderwood's work is an ably argued treatise on the subject, and oddly enough, in the chapters on Sensory and Rational Discrimination and Rational Life, he quotes from the earlier works of Mr. Spencer to substantiate his own attempted refutation of the Darwinian theory. At the outset he asks, "How has he (man) found his place on the summit of existence, and what has he done since coming to his heritage?" Then follows a chapter on the characteristics of human life, in which the contrasts between organic and rational life are treated; the author asserting that intelligence alone makes man the master in Nature; that in human activity "dualism of function is complete"—i. e., both rational and organic life—whereas "evidence fails when we look for independent action of intelligence in animals." And he continues: "We do not find that any of them" (animals) "in their natural state rise above interpretation of signs."

The chapter on Sensory and Rational Discrimination presents forcible argument demonstrative of this duality of function culminating in man's possession of rational power, by virtue of which "every member of the race goes forth on his way as a free man, taking possession of his inheritance in the earth. For every man who does not lose his way in darkness or through blinding passion . . . a rich possession is waiting, quite above supply of the common requirements of organic life. Science is his servant, literature is his property, philosophy is his guide in higher thought, revelation becomes his inspiration. Under warrant of abundant evidence, we distinguish two worlds in Nature—the world of matter and the world of mind; a world visible to the eye, a world invisible to organism—visible only to rational insight. . . . Thinkers of quite opposite schools are agreed that there is no possible science of Nature which does not distinguish between the material and the spiritual, between that which is known by sense and that which is known in consciousness. Nature's testimony admits of no doubt as to the reality of these separate spheres."

The chapter on Animal and Rational Intelligence is a searching examination of the difference between the two kinds, or rather three kinds, for a distinction is made between the intelligence of the higher and that of lower animals. A weakness is found in the argument for evolution of mind; for to prove it "we must open a road from sensory impressions to ideas of objects, and from these to general abstract ideas, and this must be such a road as the higher mammals could find for themselves before man's appearance on the earth. Here is the essential test of an all-embracing scheme of evolution; to account for interpretation of sensory experience . . . this problem separates us from much that has been already assured in natural history, strongly favoring evolution." The argument, as to man, is continued in the chapter on Rational Life, where the science of mind is found to outstretch the science of biology, and man's life to be superior to all animal life, possessing powers which are not shared by the animals; having possibilities and a destiny peculiar to himself, impossible to organic life, even to the organism which is part of his own being. This conclusion as to the inability of biology to present a science of human life "is reached by all that biology has to offer by way of explanation." All that has been demonstrated as to the action of the nerve system and of the brain is accepted and turned to full use, but it "carries no explanation of the activities of the rational life."

The lines of investigation pursued do not include any examination of Christianity as a supernatural religion, but only as a spiritual force contributing to the advance of the race, certain of the characteristics of which "have wielded a mighty influence in the course of the ages."

Summing up his investigations of the theories of Darwin, Wallace, and their followers, the author claims that the origin of man is completely severed from the scheme of organic evolution. "Man has his place in a physical system within which all is subject to decay and death; he has his place in a spiritual system, within which is no trace of death, but promise of continuity beyond the present state. Evolution has turned attention on different phases of the origin of existence on the earth. It helps us better to see how varied these origins have been." But it is insufficient to account for life itself. It stands "before us an impressive reality in the history of Nature. But this evolution is only a limited cycle, within the greater cycle of Being and its history," and all leads to the conclusion that "there is a power operating continually in Nature, which does not come within range of the observation possible to scientific modes and appliances, yet to which science is ever indirectly bearing witness."

THE POLITICAL VALUE OF HISTORY. By W. E. H. LECKY, LL. D., D. C. L. New York: D. Appleton & Co. Pp. 57. Price, 75 cents.

THIS is a reprint of a lecture delivered before the Birmingham and Midland Institute, of which the author is president. The words of such a man as Mr. Lecky, on the value of history as a precedent for guiding political policy to-day, can not fail to be of value. The question is one which has by no means always been answered affirmatively, and one which in recent times has been much argued.

Mr. Lecky first shows how history arose and what was its original function, and then briefly traces its development as a science down to the present century. That he has taken a judicial attitude is shown by the following passage: "Nor will any wise man judge the merits of existing institutions solely on historic grounds. Do not persuade yourself that any institution, however great may be its antiquity, however transcendent may have been its uses in a remote past, can permanently justify its existence, unless it can be shown to exercise a really beneficial influence over our own society and our age. It is equally true that no institution which is exercising such a beneficial influence should be condemned because it can be shown from history that under other conditions and in other times its influence was rather for evil than for good." He dwells on the necessity for understanding the "dominant idea or characteristic of the period" which the student is investigating; "what forces chiefly ruled it, what forces were then rising into a dangerous ascendency, and what forces were on the decline." He speaks of the im-

portance of the history of institutions, their changes to meet new wants, and their inevitable fall, although, perhaps, by a process of slow decay, upon failure to adapt themselves to new requirements. He says: "There is probably no better test of the political genius of a nation than the power which it possesses of adapting old institutions to new wants." Next he considers the value of a study of the great revolutions, discussing the two theories extant as to their causes and possible avoidance. "My own view of this question," he says, "is that although there are certain streams of tendency, though there is a certain steady and orderly evolution that it is impossible in the long run to resist, yet individual action and even mere accident have borne a very great part in modifying the direction of history." Having characterized history as one of the best schools for that kind of reasoning which is most useful in practical life, teaching men to weigh conflicting probabilities, to estimate degrees of evidence, to form a sound judgment of the value of authorities, Mr. Lecky concludes by observing that its most precious lessons are moral ones. It expands the range of our vision and teaches us, in judging the true interests of nations, to look beyond the immediate future. A perusal of this little book will well repay the general reader and be especially valuable to those engaged in the study or teaching of history.

THE INTERPRETATION OF NATURE. By NATHANIEL S. SHALER, Professor of Geology in Harvard University. Boston and New York: Houghton, Mifflin & Co. Pp. 305. Price, $1.25.

HOWEVER widely apart the theologian and naturalist may be at the present moment, the time is not far distant, according to Prof. Shaler, when they may stand upon common ground. In the next century science may even people the unknown with powers justly inferred from their manifestations. There will be no longer a natural and a supernatural realm, but one universe "through which the spirit of man ranges with ever-increasing freedom."

We may trace the evolution of scientific inquiry to the germ of curiosity evinced by the lower animals. The early races of men attributed the control of Nature to spirits like themselves. These were gradually endowed with greater powers until the idea of a hierarchy of gods was reached, and among the more intellectual nations this culminated in monotheism. Theologic explanations, however, could not satisfy the interrogative impulse possessed by the Aryan race, and especially by the Greeks. The want of scientific interest shown by the Romans is ascribed by the author to a different racial inheritance, and the long period of unquestioning quiet is not charged to the soporific influence of Church authority so much as to a religious bent derived from Semitic ancestors. With the revival of learning came the resurrection of inquiry, and to the system of Aristotle the moderns added the method of verification by experiment.

The naturalist is generally too apt to look upon the course of Nature as invariable, since he knows that any physical state is the resultant of previous conditions, and that the quantities of force and matter are unalterable. There are, however, phenomena which can not be predicted, the outcome of revolutionary changes that transcend experience. The crises at which these occur are termed critical points, and are typified by the point at which an orbit passes from the parabolic to the hyperbolic form. Similar results follow alterations in temperature and the manifestation of latent inheritances.

In considering the march of the generations it is seen that the psychic progress of man is unparalleled by anything in the evolution of species. The generations are also bound together by vast stores of experience and knowledge, which the human race accumulates and transmits in various ways to the young, so that great advance is made possible.

Man owes his moral development to the exercise of altruistic motives—sympathy with his kind, with animals, with God and Nature. We can follow these to lowly beginnings, but can not account for their growth by any theory of selection. The determinative influences are hidden, "unless we assume a law of moral advance."

As to the immortality of the soul, "it is easier to suppose that an individual mind can be perpetuated after death in a natural manner than to explain the phenomena of inheritance." The naturalist thus finds that, in

order to interpret the latent powers of a molecule, or the transmission of organic tendencies, he must assume the intangible, and endow matter with a sort of soul. He also derives from his study of Nature motives that are moral and a confidence akin to faith. This is close upon religious territory, and the preacher may utilize it.

The substance of this volume was first presented in lecture form at Andover. It is suggestive, and teaches a form of monism, though scarcely such as Prof. Haeckel would indorse.

HORTICULTURE. Ten Lectures delivered for the Surrey County Council. By J. WRIGHT, F. R. H. S. With Thirty-seven Illustrations. Pp. 154. New York: Macmillan & Co. Price, 35 cents.

THIS "Primer of Horticulture" is designed as an introduction to a scientific and practical study of gardening and fruit-growing, either for the small householder, who enjoys the care of his seven-by-nine piece of ground, or for the farmer to whom the best and most economical methods are matters of "dollars and cents."

The first lecture is devoted to the question of land allotments, with which we in the United States are not concerned. The second lecture is headed The Soil, its Nature, Preparation, and Improvement. This chapter contains in clear and concise language matter of the first importance to every farmer—matter, in fact, without which the tiller of the soil is as much handicapped as was the compassless mariner—matter usually, however, locked up in large, expensive, and technical works, and therefore not at the command of the working farmer. Lecture III is devoted to the raising of "crops, plants, and trees," and includes, among many other important matters, a history of the seed from its formation to the development into a new plant; a description of the various methods of grafting, and the why and wherefore of fertilization. Lecture IV treats of the Food of Crops—Manuring the Soil, and, like Lecture II, is full of practical instruction. The Enemies of Crops and Trees, in the shape of weeds, birds, insects, fungi, etc., are next considered. Lecture VI deals with the very important part of the farmer's work—planting. In Lectures VII and VIII what are the most profitable crops is the question answered. Lecture IX considers the Preservation and Disposal of Garden Produce, including Flowers and Fruit; and Lecture X closes the book with a talk on the desirability of exhibitions and fairs and the necessity for high ideals in gardening. The construction of the work is admirable, and it might be read with profit by many scientific men as a model for popular scientific exposition. Great care has been taken to select the most important aspects of the topic discussed, the essential facts being presented in clear and untechnical language, while the subject is not overburdened with detail.

HOW TO KNOW THE WILD FLOWERS. By Mrs. WILLIAM STARR DANA. New York: Charles Scribner's Sons. Pp. 298. Price, $1.50.

THIS title will attract the attention of lovers of Nature, especially if they are able to spend the summer months in the country. An acquaintance with natural history, even if it be slight, unquestionably adds very much to the pleasure of out-of-door life, rendering interesting, localities which but for their animal and vegetable forms would be quite the reverse, and making doubly pleasurable a sojourn in a region where scenic beauties are also present. The author's purpose has been to give the reader a "bowing acquaintance with the common wild flowers of our woods and fields"; but, while the attempt is well meant, we can not say that it is a success. There are descriptions of most of the common wild flowers of the Middle States, with the exception of "flowers so common as to be generally recognized," "flowers so inconspicuous as generally to escape notice," and "rare flowers and escapes from gardens." But the descriptions, particularly of essential parts, resemble those in Gray's Manual, and are too short and technical for the uninstructed observer. What remains is more of a literary than a scientific character, there being considerable poetry and more or less sentimental comment. The illustrations, of which there are one hundred and four, are not at all satisfactory as an aid in identification, the purpose for which they are intended. A classification based on colors is introduced which is necessarily of little value, as the

colors of flowers shade off so imperceptibly into one another, and are at the same time so variegated and inconstant, that they are likely to mislead even the trained observer.

The book will do good, however, if it incites to the study of a department of Nature which more than any other is calculated to stimulate the powers of observation.

THE SILVER SITUATION IN THE UNITED STATES. By F. W. TAUSSIG, Ph. D., Professor of Political Economy in Harvard University. New York and London: G. P. Putnam's Sons, 1893. Pp. 133. Price, 75 cents.

THIS work is divided into two parts. The first discusses the history of the "silver legislation" and the economic conditions which have been brought about by the adoption of a silver currency in 1878. The second portion of the book considers the arguments in favor of a silver standard. In the chapters under the general title, The Economic Situation, Prof. Taussig closely analyzes the movements of gold and silver during the last fourteen years. He does not believe that the gold reserve of $100,000,000, fixed as the minimum by Congress, can very measurably be increased, and he attributes the decrease in the amount of gold held by the Treasury—from $190,000,000 in 1890 to $108,000,000 at the beginning of the present year—to the fact that "the great sums due the United States by foreign countries" are not paid for by the return of gold, but by "the transmission of American securities held by foreign investors and sent by them for sale in the United States." He claims that the Treasury estimate of the stock of gold in the United States is many millions of dollars "in excess of the actual stock." Having summarized the arguments in favor of silver, quoting the very words of those who present them, "as compared with commodities silver has been more steady in value than gold," and that, "so far as the attainment of the closest possible approach to the ideal justice is concerned, a silver standard would have served the purpose better than a gold one"—the author offers as a simple answer to them the facts he has recited in his preceding pages, and says that the silver men "have not made out their case against the existing order of things. There are no serious evils due to an insufficient supply of money." These and other negative reasons apply to the arguments of those who favor international bimetallism and of those who favor the independent use of silver by the United States. When we consider the importance not only of stability in the medium of exchange, but of general confidence in that stability, these and other negative names which are mentioned ought to suffice for rejecting the proposals of the silver advocates. But there are positive reasons in addition. The eventual effect of a silver standard must be to cause a rise in prices—not immediate, but certain. This, while the present tendency to falling in prices, with stationary or rising incomes, work no hardships to debtors, would be fraught with real and serious inconveniences to creditors. Other positive reasons lie in the conditions of the production and use of silver at the present time, which are increasing with extraordinary rapidity. Another objection to a change to a silver standard is the immorality of the disposition to tamper with the currency as a remedy for real or fancied evils. Gold, on the other hand, performs the functions of a measure of value and a standard of value with as close an approach to perfection as there is any reasonable ground for expecting from any monetary system. For these reasons the schemes proposed for a tabular or multiple standard of value do not seem called for by any serious exigency not met by the gold standard. The book contains some useful comparative statistics and a comprehensive chart of fluctuations in gold and silver.

TELEPHONE LINES AND THEIR PROPERTIES. By Prof. W. J. HOPKINS. New York: Longmans, Green & Co., 1893. Pp. 258. Price, $1.50.

THIS is a work which has for its object a more complete account than has yet been given of the telephone line, not only its mechanical construction, but its electrical properties, and the way telephonic transmission is affected by telegraphic and other electric currents. The range of subjects comprise a brief account of overhead construction in city lines, and a somewhat full one of underground work, in which the relative advantages and disadvantages of various kinds of

conduits are considered. Long-distance lines, the various kinds of wire suitable for telephone use, insulators, and the exchange system are among the subjects treated of in the part of the book devoted to the mechanical construction of telephone lines. A chapter upon the propagation of energy, in which a brief account is given of the modern view of electric currents, precedes the consideration of the electrical properties of the telephone line. Among the subjects discussed in this portion of the work are self-induction, interference from outside sources—such as air and earth currents—telegraphic induction and induction from electric lighting and railway circuits, properties of metallic circuits and of cables. The work is written for the practical telephone constructor and for students, and will doubtless prove a valuable work of reference.

How to manage the Dynamo. By S. R. Bottone. New York and London: Macmillan & Co., 1893. Pp. 63. Price, 60 cents.

This little manual is addressed to those who have the care of dynamos, and is clearly and directly written and free from all technicalities. Instructions are given as to properly setting the machine so as to avoid vibration, and the different parts—the field magnets, armature, and commutator—are briefly described, and instruction given for their proper care. Simple methods of determining and locating leaks are also given. The book closes with a list of the chief electrical terms, and is provided with an index.

The Transmitted Word. By W. J. Keenan and James Riley. Boston: Dorchester Printing Co., 1893. Pp. 113. Price, 75 cents.

The authors of this essay state its purpose in the preface as follows:

"To know somewhat of the application of this great force, which man has discovered and called electricity, these pages are written. They are free of all technical terms. Simplicity has been the constant aim. The student's text-book on electricity has been written. The public's book has not been written. And, as we are taught to know ourselves, so should we know the forces that surround us. Especially so if we use these forces. Every subscriber of the telephone should know the rudiments of its action. This is why this book is put forward. It is intended as a primer in telephonic and other kindred instruction. . . ."

This purpose of the authors is laudable enough, and, if it had been adhered to, they might possibly have produced a useful book. Their real aim seems, however, to have been to give an exhibition of what they probably regard as fine writing, using the telephone as an excuse for their literary effort. The book is written throughout in the most approved style of sophomoric composition, and contains very little real information about the telephone. The reader who had no previous knowledge of the subject would have a hard time indeed in trying to get any clear ideas of the Blake transmitter or induction from the description of the authors. The book has, however, one great merit. It is short.

Man and the State. Lectures and Discussions before the Brooklyn Ethical Association. New York: D. Appleton & Co. 1892. Pp. 558. Price, $2.

This volume of lectures and addresses before the Brooklyn Ethical Society is devoted especially to subjects of current political discussion, such as the tariff, the monetary question, the negro problem, the government of cities, and kindred subjects. To those who are familiar with the discussions before the society; or who have become acquainted with the character of the work from its previous publications, no word of commendation of the quality of these papers is necessary. The addresses are thoughtful and serious discussions of current political and economic questions, and can not fail to be welcomed by all who take an intelligent interest in public affairs. It would be impracticable to attempt to give here either a *résumé* or criticism of the dozen and a half addresses which compose the volume, though some features of interest may be briefly indicated. The volume was published last year, previous to the presidential election, and the addresses were selected chiefly with reference to the questions before the country during the campaign. We have therefore a discussion of the tariff from the side of both protection and free trade, a plea for sound money, and a defense of each of the great political parties. The free-

trade side of the tariff question is presented by Mr. Thomas G. Shearman, and calls for no special comment, as he presents only the well-known considerations in favor of industrial freedom. His opponent, Prof. Gunton, however, attempts to defend protection on philosophic grounds and erect it into a permanent system instead of leaving it in the position of a temporary expedient, applicable only to the infancy of industries. He regards protection a means of maintaining the wage level of a country, by forcing a competing country to pay in duties an amount which will put it on the same basis as the country of higher wages. The tariff can in justice therefore be only sufficient to cover the difference in wages of the competing countries—a condition, it need hardly be said, that would not suit our tariff beneficiaries at all. Dr. Lewis G. Janes contributes a thoughtful paper upon the problem of city government, which is concerned mainly with pointing out the difficulties of the problem rather than with suggestions as to the solution. He insists, however, that the proper form of city government must be a matter of growth, shaped and determined by our political life, and that the example of foreign cities can be of but little use in helping us to solve the problem of American city government. Other essays of interest are Mr. John A. Taylor's defense of the independent in politics, Prof. Le Conte's discussion of the race problem in the South, the monetary problem by William Potts, and representative government by Edwin D. Mead.

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POPULAR MISCELLANY.

Explosion of Kitchen Boilers.—The most common cause of the explosion of kitchen-range boilers is frost. If the pipes are frozen so that the steam raised by the fire can not escape, the danger of an explosion is very great. This should be prevented, where there is a liability of the pipes being frozen, by protecting the pipes and apparatus generally from the effects of frost. Protection may be given by covering the pipes with hair felt. Some boilers are in danger of explosion from the failure of water supply; but in the modern system of cylinder the hot-water tank is not entirely emptied, and a sufficient supply of water is usually left to carry the fire several hours. Boilers in districts where the water is "hard" may fail in consequence of the accumulation of an incrusted deposit within them and the pipes, whereby the pipes may be in time stopped up. The pipes, however, usually give warning of this danger long before it becomes imminent, in the shape of violent noises and vibrations proceeding from the apparatus, which become unendurable and have to be removed before the explosion takes place. Finally, a safety-valve is a sovereign preventive of explosions from whatever cause.

The Australasian Association.—The next meeting of the Australasian Association for the Advancement of Science will be held in Adelaide, South Australia, beginning September 25th. The meeting will be presided over by Prof. Ralph Tate, of the University of Adelaide. The presidents of sections will be: Astronomy, Mathematics, and Physics—H. C. Russell, Government Astronomer of New South Wales; Chemistry—C. N. Hake, of Victoria; Geology and Mineralogy—Sir James Hector, Director of the Geological

Survey of New Zealand; Biology—C. W. De Vis, of Brisbane; Geography—A. C. MacDonald, of Victoria; Ethnology and Anthropology—Rev. S. Ella, of New South Wales; Economic Science and Agriculture—H. C. L. Anderson, of New South Wales; Engineering and Architecture—J. R. Scott, of Canterbury, New Zealand; Sanitary Science and Hygiene—A. Mault, of Tasmania; Mental Science and Education—Henry Laurie, of the University of Melbourne. The association has been in existence since 1888. The four previous meetings have been held at Sydney, Melbourne, Christchurch, and Hobart. The association has grown steadily since its beginning and now numbers about nine hundred members. The season of the meeting—when spring is passing into summer—is recommended as being one of the most favorable to visit South Australia, and particularly attractive to naturalists.

Derelicts on the Ocean.—We gave several months ago an account of the wanderings of the derelict schooner W. L. White, which, after having been abandoned not far from New York in the great blizzard of March, 1888, went ashore ten months afterward near the Hebrides, after having drifted five thousand miles back and forth on the Atlantic Ocean. The history of several other vessels pursuing a similar career may be found in the bulletins of our Hydrographic Office. The schooner Twenty-one Friends, abandoned in March, 1885, one hundred and sixty miles from Chesapeake Bay, drifted two thousand miles in four months, and was seen near Cape Finisterre at the end of eight months. The Ethel M. Davis drifted four thousand four hundred miles in three hundred and seventy days, and the David W. Hunt four thousand eight hundred miles in three hundred and forty-seven days, during which she was seen by forty-one passing ships. According to the United States Wreck Chart of the North Atlantic, there were forty-five derelict vessels in that ocean, and more than half of them were in the route of the transatlantic line steamers. These waifs are very dangerous, for their positions and courses are unknown, they are under no control, and may appear at any unexpected moment, at night or in a fog, or in storms, to crash into and sink whatever vessels they may meet. Possibly some of the steamers that have been lost and left no record have gone down after meeting with them.

Indo-China.—The whole region of Indo-China, as the Hon. G. N. Curzon, M. P., pointed out in a lecture before the Royal Geographical Society, is dominated by its great rivers, and may be divided into the mountain districts of the north, cleft by vast gorges; and the low plains of the south, mainly composed of alluvial deposits, where the coast lands are steadily encroaching on the sea. In the seventh century, Tongking, now sixty miles inland, was on the coast. A very remarkable feature, which gives parts of the coast a beauty comparable with that of the Inland Sea of Japan, is a broken belt of limestone cut into curious, flat-topped sections of all sizes, and perforated by the sea or rivers with many fantastic caves and tunnels. The masses of caverned rock rise to a height of from fifty to five hundred feet, and are best seen in the Bay of Along in Tongking. In Annam Mr. Curzon traveled to Huć by the "Mandarin's Road," a track which is carried over several *cols* by some skillful engineering in the form of rock staircases. Huć is a city of great interest, is beautifully situated, and is near a number of magnificent ancient tombs.

Mongol Waterworks.—The city of Aurungabad, India, is supplied with water by a system constructed three hundred years ago by Malik Umber, the Viceroy of Shah Jehan. Though the water came regularly, no one in recent times had determined the source of the supply. All that was known was that the water came from the stone image of a bull situated seventy feet above the level of the town, while further search was defeated by the superstition of the natives. The matter has been recently investigated by Mr. Beveridge, an engineer in the service of the Nizam, who found that the Gya Mookh, as it was called, was supplied by a pipe and a covered channel. This channel was traced up for a considerable distance, but the work was suspended on account of unhealthy emanations and the difficulties interposed by superstition. It was resumed by another engineer, Mr. Massett, who found that the channel crossed the Ursool River by a si-

phon made of cut stone pipes, and ended a short distance thence in a large infiltration gallery, the roof of which is arched over with brick, supported by the natural sides of the excavation formed of trap rock. This gallery, which is 9,460 feet long, is twelve feet below the bed of the river, and evidently obtains its supply from subterranean stores from the subsoil rock on its way to its natural outlet, the river. The position of the gallery has been chosen with great astuteness, which shows that the engineer of Malik Umber knew exactly what he was about. Behind it stretch hills surrounded by table land, having an area of twenty miles, with a configuration that would argue that the collecting area of the gallery must be at least twelve square miles. The hills contract in the direction of the river, till a semicircular valley is formed bounded by the river Ursool. The gallery has been so placed between the river and the hills as to form the chord to the arc. The works are now dilapidated, and do not furnish one third of the supply of water for which they are calculated.

Hygienic Value of the Bicycle.—The bicycle is highly commended as a hygienic instrument in a paper by Dr. Seneca Egbert on that vehicle "in its relation to the physician"—the relation, according to the author, being apparently one of keeping the doctor away. "In the first place," he says, "as an exercise cycling is superior to most if not all others at our command. It takes one into the outdoor air; is entirely under control; can be made as gentle or as vigorous as one desires; is active and not passive; takes the rider out of himself and the thoughts and cares of his daily work; develops his will, his attention, courage, and independence; and makes pleasant what is otherwise most irksome. Moreover, the exercise is well and equally distributed over almost the whole body, and, as Parkes says, when all the muscles are exercised no muscle is likely to be overexercised. This general muscular exercise also has its direct effect upon the other and vital organs of the body, the heart, lungs, and digestive organs especially; and the improvement in general health and digestion, after a few weeks' riding, is by no means illusory or fleeting. We all know that the trouble with many of our patients is purely functional, and that their maladies have been brought on by lack of pure air, too little exercise, and too much mental worry over their work or business. For these the bicycle furnishes an agreeable remedy." It is thus recommended specifically for venous or anæmic dyspepsia, torpor of the liver and intestines; for tuberculous diathesis, incipient consumption, nervous troubles, rheumatic disorders; and "is destined to be of great benefit to women. It gets them out of doors, gives them a form of exercise adapted to their needs, neither too violent not too passive, one very pleasant withal that they may enjoy in company with others or alone, and one that goes to the root of their nervous troubles." A correct position in bicycling is important; it is the upright one, and not "a posture resembling a half-opened jackknife," which cramps the chest and interferes with the flow of blood. Excess either in quantity or intensity of bicycle work must be avoided.

"Crocodile Tears."—The figure "crocodile tears" rests, it appears upon a real fact, although the tears appertain more particularly to the snake. According to the explanation of the matter offered by Mr. R. H. Burne, of the Royal College of Surgeons, the eye of the snake is protected from dust, etc., by the eyelids, which are transparent and joined to each other so as to form a layer of skin between the eye and the outer lid; in other words, the snake always goes about with its eyelids shut. Thus the real occupation of the tears is gone, there being no dust on the surface of the eye to be washed off. Instead, however, of the tear-gland being reduced in size, it is exceptionally large; in some snakes, indeed, in which the eyes are reduced and practically functionless, the gland is some two or three times larger than the whole eye. This peculiar state of affairs was explained by the discovery that the gland had lost its connection with the eye, and opened through the mediation of the tear-canal directly into the mouth, thus doubtless, by means of its secretion, making the descent of Avernus smooth and easy to any unfortunate creature that this snake may have taken a fancy to. This is possibly not quite what was meant by the fable of the crocodile's tears, but it affords a curious

example of how very near a false popular superstition may unwittingly come to the truth.

The Limits of Parental Discipline.—The point to which parental discipline may go might be made a subject of fruitful study. It is agreed, of course, that the child must be trained and kept in a certain degree of subjection for its own good and to prevent its becoming a nuisance to society, and a certain pliancy to the control of superiors is, as a writer in an English journal well remarks, absolutely essential to the organization of a household, a school, or a state. "Discipline," this writer continues, "implies ready obedience to orders of which the reason is not understood; but it should always rest on the belief that these orders are given for sufficient reasons, and not for the mere satisfaction of those who give them in seeing them obeyed." The theory of "breaking" the will of the child, in which parents and teachers indulge, is all wrong. The first thing a superior has to learn "is that there is no such thing as property in the character of a human being; that when the individuality of a character has to be suppressed—and of course the organization of society requires that it must often be suppressed—it is suppressed either for its own good or for the good of others to whom consideration is due, and that, beyond the limits of these obligations, individuality, far from being a hindrance and annoyance to be got rid of as completely as possible, is a distinct gain to the universe. The wish of some parents to wield as much power over the wills and characters of their children as they do over the motions of the horses they ride or drive is not only a foolish but an evil wish. To get excellent instruments on which they can perform as they would perform on a piano, always eliciting exactly the particular vibration they desire and expect, is clearly not the true object of family life. On the contrary, character, far from being an instrument to be performed on by others, should always be a new source of life and originality, which no one should be able to govern despotically from the outside, and which, even from inside, is in a great degree a mystery and a marvel to him who has most power over it. The mere notion of making character a kind of repeater, which responds by a given number of strokes to the parent's touch, is a radically absurd one. What a parent ought to wish for is, indeed, instant obedience to orders given for the child's good, and an eager intelligence in the child to trust its parent; but beyond this, as much that is distinct and individual, and that has a separate significance of its own, as the child's nature can provide."

Vitality in Intellectual Work.—So far from intellectual work diminishing vitality, says a writer in the London Spectator, the chiefs of all the intellectual professions are, and in recent times have been, men who have passed the ordinary term of years with undiminished powers. In politics the principal leaders whom this generation has known have been Earl Russell, Lord Palmerston, Lord Beaconsfield, and Mr. Gladstone, and every one of them was at seventy in full vigor, while the last, at eighty-three, is still a mighty power in British politics. Prince Bismarck remains at seventy-eight a force with which his Government has to reckon; while the will of Leo XIII, an exceptionally intellectual Pope, at eighty-three, is felt in every corner of the world. "The most intellectual and successful soldier of our time, the man who had really thought out victories, Marshal von Moltke, was an unbroken man at ninety and more years. No men dare compare themselves in literary power with Tennyson or Carlyle, Victor Hugo or Von Ranke, and they all reached the age which the author of Ecclesiastes declared to be marked only by labor and sorrow; as also did Prof. Owen, whose life was one long labor in scientific inquiry; and so also has Sir William Grove, one of the most strenuous thinkers whom even this age of thinkers has produced. We might lengthen the list indefinitely; but to what use, when we all know that the most intellectual among lawyers, historians, novelists, physicians, politicians, and naturalists survive their contemporaries, usually with undiminished powers? In all statistical accounts, the clergy, whose occupation is wholly intellectual, rank first among the long-lived. A little lower down in the scale the most hale men among us are those who have been doing intellectual work, often extremely hard work, through all their lives,

and who are still so strong that all the professions are affected by their resolution not to retire, and the inability of younger men to invent a reason for making their retirement compulsory. To say that they are picked lives is false, for they are so numerous that the intense vitality of the old and intellectual actually affects the organization of society; and to say that the unintellectual flourish equally well . . . is not probably true." The stupid among the cultivated do not survive in anything like the same proportion. Among the ladies of the century, likewise, the oldest have been the highest.

Science in Elementary Schools. — Remarking, in a paper, on the Place of Science in Elementary Schools, Prof. Samuel G. Williams observes that all sciences of Nature have their very foundation in correct and definite observation of the facts which Nature presents. It is therefore of the very essence of science that the pupil should be first of all taught to observe, to use his own senses directly upon appropriate objects, and thus to increase their delicacy and power by repeated employment; and, moreover, to give an account of what he has in any way experienced, that the fact observed may be assured and that its results may be embodied in language. When even the youngest child is thus brought into direct contact with Nature, he is quick to note the infinite variety which it presents, to see that this object is similar to that and quite unlike the other. Incipient powers of comparing and judging emerge, and should be appealed to in all possible ways; for ripeness of judgment results only from repeated acts of judging. Rude and then more perfect classifications result from the grouping of the like and the separation of the unlike; and the beginning of class notions is made which future experience shall fill with even clearer and more definite meaning, until gradually and almost unconsciously the pupil grows to a considerable mastery of the general and abstract terms which make so large a part of the language of the more enlightened members of his race. Even those large operations called generalization and induction from observed facts and phenomena, should have their definite beginnings in some part of the elementary course, and especially in certain easy and natural observations of physical phenomena. The youngster whose attention has a few times been directed to the flash of a distant gun and the report which more tardily reaches his ear, can readily be brought to infer that sound travels more slowly than light, and to apply his generalization to lightning and the resultant roll of thunder. Thus, it is obvious that the aim which the science teacher should keep ever clearly in view is first of all to train the senses to ever-growing accuracy and completeness in observation; as accessory to this, to secure the expression and interpretation of what is observed; to neglect no opportunities, however slight, for the exercise of judgment; and to advance, gradually indeed, but always with definite purpose, toward the classification and generalization of results secured by direct personal observation. It will be observed that the keynote of the whole matter is *direct contact* with Nature, and diligent study of what she has to teach through the proper use of trained senses.

Fighting the Gypsy Moths.—The State Board of Agriculture of Massachusetts, through its agents, Prof. C. H. Fernald and E. H. Forbush, appears to be carrying on an effective campaign against the gypsy moth. The work was begun systematically in 1890, so that only the results of the first two season's operations have yet been embraced in the official report; yet, though the attempt was the first on a large scale ever made in the Commonwealth to destroy a species of insect, and the operators were without experience, a very perceptible reduction in the number of the insects and in the damage by them was realized; and trees and orchards that were stripped in 1891 enjoyed the full luxuriance of their foliage in 1892; and the members of the board are now confident that it can be eradicated. Destruction of the insect is found to be a most effectual method of eradication. Another method is to entrap the caterpillars within bands of burlap fastened around the trees. They are in the habit of seeking shelter during the daytime, and if the holes in the trees are stopped up they resort to the burlaps and can then be easily destroyed. When the insects get into the woodlands, dealing with them is more difficult, on account of the un-

derbrush and the dead leaves on the ground. In these cases the board suggests clearing away the brush and the worthless trees and careful burning over the ground. When the work was first begun it was thought that the moth occupied only a small part of one town. It was, however, shown that it infested thirty towns and cities. As the moth multiplies rapidly and eats everything that is foliage, leaving nothing behind, the danger arising from its presence is really a matter of national importance.

Superstitions about Snakes.—In his refutation of Some Superstitions about Snakes, Dr. Arthur Stradling tells of a "weirdly horrible" fancy of the Singhalese Tamils, that every time the cobra di capello bites and expends its venom after it has attained its full length, it loses one joint of its spine. The process of curtailment goes on until the whole body has disappeared, with the exception of the head and hood, both of which have undergone a sort of compensating enlargement, while the mouth has widened until the face of the reptile presents the aspect of a malignant toad. With increased death-dealing powers, the exercise of which subjects it to no further penalty, it now betakes itself to an aërial mode of life, flying by the flapping of its extended sides after the manner of a bat. A somewhat similar fable is heard among the natives of Bengal, who furthermore declare that this square-winged fiend is the only snake that refuses to be frightened away when the name of the king of the birds (Garudá) is called aloud in its hearing, and that the docking of the vertebræ corresponds to the number of human lives which the cobra has sacrificed in former days. This superstition is curiously akin to that held by the settlers in many parts of America, to the effect that the rattlesnake acquires a new thimble to its rattle for every man it kills.

Cruelty to Children.—From the report of the English National Society for the Prevention of Cruelty to Children it appears that poverty and large families are not a common cause of cruelty. On the contrary, the worse the cruelty the better, on an average, were the wages of the cruel parent and the fewer the children to whom the cruelty was displayed. The report further shows that the effect of warnings and even of prosecution and conviction on cruel parents is not to inflame their passions against the children who have been the occasions of their alarm and punishment, but to increase the regard of the cruel parent for the children, and for those who interfered to protect them. The cruel parent becomes less cruel when he finds that the law concerns itself with his children, and often seems to discover that there is a good deal more to like and respect in the children who had been cruelly treated, and in those who took the children's part, than he had perceived before. Summing up the domestic effects of a visit of the society's inspector, a mother said to one of the secretaries of the society, "It is like courting over again." In other words, as an English journal views the case, the woman had risen in the estimation of her husband as soon as he found that the law and public opinion of the neighborhood were on her side. Instead of increased irritation against his wife for not siding with him, he felt her to some extent raised above him, and began to see her with new eyes as a person whose approbation it was worth while to gain. The prevalence of cruelty among well-to-do parents rather than among the lowly is, perhaps, to be explained on the same principle. Cruelty is favored by the sense of arbitrary power, and by the absence of any feeling of responsibility to others. Anything that stimulates the sense of irresponsibility and independence increases cruelty; anything that diminishes that sense, anything that brings home to the heart the feeling of a social or physical yoke, diminishes it.

Steamboats on Long Island Sound.—From a Review of the Past and Present of Steam Navigation on Long Island Sound, published by the Providence and Stonington Steamship Company, it appears that experiments to move steamboats were made by several persons toward the end of the last century on the Hudson and the Delaware. John Fitch's was the first, and his skiff, rowed by oars or paddles on the sides, moved by cranks worked by steam machinery, was publicly tried on the Delaware, July 27, 1786. An amazing contrast is presented between its portrait and those of the Stonington line's

latest masterpieces in steamboat architecture, the Maine and New Hampshire. Fitch's first boat for carrying passengers was completed in 1788. It was worked with oars or paddles placed at the stern and pushed against the water, and took thirty passengers from Philadelphia to Burlington in three hours and ten minutes, or over six miles an hour. Fitch's third boat was advertised in 1790 as "the Steamboat" to run to Burlington, Bristol, Bordentown, and Trenton, and return the next day. Congress adjourned to see it start, and the Governor and Council presented it with a flag. The Eructor Amphibolis of Oliver Evans was a combined locomotive and steamboat—a scow on wheels with modern axletrees and a paddle wheel behind, to travel as a wagon on land and as a boat in water. It was propelled by the engine up Market Street in Philadelphia and round the circle to the waterworks, where it was launched into the Schuylkill. The paddle wheel was then applied at its stern, and it thus sailed down that river to the Delaware. Then came Fulton's Clermont, steaming from New York to Albany in thirty-six hours, the pioneer in a fleet which numbered eight boats in 1816. The first steamer on Long Island Sound was the Fulton, a vessel with one mast and sloop rigging, which depended on its sails to accelerate its speed, and began its trips to New Haven in 1815; and the Fire Fly, one of Fulton's boats, first rounded Point Judith and reached Newport in 1817. The establishment of the packet line between Providence and New York was an important event in American travel, and the departure and arrival of the boats presented an imposing spectacle. The fare was ten dollars, and the first advertisement of the company appeared under the cut of a man-of-war, with portholes open and every sail set. In their painting, these boats, according to the account, somewhat resembled a barber's pole, being striped in curious designs.

Unsolved Problems in Geology.—Rather technical is Mr. G. K. Gilbert's review of the continental problems that are before geologists for solution, made in his presidential address before the Geological Society of America; but he enumerates several such problems and questions on which no clear light has yet been thrown. As he summarizes them, it appears that "the doctrine of isostasy, though holding a leading position, has not fully supplanted the doctrine of rigidity. If it be accepted, there remains the question whether heat or composition determines the gravity of the ocean beds and the levity of continents. For the origin of continents we have a single hypothesis (that laid down by Prof. Dana in his Manual of Geology), which deserves to be more fully compared with the body of modern data. The newly determined configuration of the continental mass has yielded no suggestion as to its origin. The cause of differential elevation and subsidence within the continental plateau is unknown and has probably not been suggested. The permanence of the continental plateau, though highly probable, is not yet fully established; and the doctrine of continental growth, though generally accepted, has not been placed beyond the field of profitable discussion. Thus the subject of continents affords no less than half a dozen great problems, whose complete solution belongs to the future. It is not altogether pleasant to deal with a subject with regard to which the domain of our ignorance is so broad; but, if we are optimists, we may be comforted by the reflection that the geologists of this generation, at least, will have no occasion, like Alexander, to lament a dearth of worlds to conquer."

NOTES.

Wood ashes are recommended in the American Agriculturist, by Mr. J. M. Stahl, as a valuable medicine for farm animals. The author keeps them, with charcoal and mixed with salt, accessible to his hogs, with the best effects; and he furnishes them to his horses by putting an even teaspoonful with the oats twice a week or by keeping the ashes, with the salt mixture, constantly before the animals.

The most striking feature of Mr. A. T. Drummond's examination of the colors and times of flowering of five hundred and thirty-nine of the plants of Ontario and Quebec is the preponderance of white flowers, which form rather more than one third of the whole. Following them are the yellow flowers, largely composites, which include about one quarter; while the purples and blues are much less numerous, and comprise about one ninth and one tenth respectively of the whole. In time of flowering April, May, and

June are remarkable for the prevalence of white; July, August, and September of yellow; and September and October of purple and blue.

THE caves of Mount Elgonin, East Africa, extend right round the mountain and occur in the lava as well as in the agglomerate beds. Mr. J. Thomson believes that they are old excavations; but a correspondent of the London Times, who visited them in February, 1893, has come to the conclusion that they are merely vast blow-holes in the mountain, "which is a grand specimen of an extinct volcano, the crater being some eight miles in diameter and from fifteen hundred to two thousand feet in depth." The mountain is fourteen thousand feet high, with a base of about one hundred and fifty miles in circumference.

THE report of the Massachusetts State Board of Health on the Geographical Distribution of Certain Causes of Death in that State presents the results of an inquiry respecting the relation of paper mills to smallpox mortality. In eleven cities and towns having extremely high ratios of smallpox mortality, six contained one or more paper mills in which rags were used; and a list of twenty-eight cities and towns in which there are paper mills contains only four places in which there were no smallpox deaths during twenty years, and non-fatal cases are known to have occurred in two of these towns. Frequent investigations of the board have shown that smallpox in Massachusetts is very often due to infected rags. In many of these cases it appeared probable that domestic rags collected in the large cities of the United States were the source of infection.

A SETTLEMENT of the silver question is propounded by Mr. Roderick H. Smith, author of several works on business, which he believes will be sovereign and permanent. It is the enactment of a law, of which he submits a draft, the essential feature of which is a provision for the issue by the Government of certificates against deposits of silver, which shall be redeemable, on demand, in an equal value of silver to the amount of the deposit. Thus, whatever may be the fluctuations in the value of silver, the certificates can never command more than they are actually worth.

THE Massachusetts State Board of Health, inquiring into the distribution of cholera infantum, finds the disease apparently promoted by the employment of mothers away from home. It also finds that a high mortality rate from cholera infantum occasionally exists in a comparatively small town where there are one or more densely populated manufacturing villages in which the conditions of living may resemble those of a large city. Upon this point Dr. Haven says: "We may have all, or nearly all, of the most vicious conditions of city life in a single tenement house in some small town of perhaps only a thousand inhabitants; we may have, that is, the heat, the dirt, the overcrowding, the bad drainage, and the artificial feeding which are the concomitants of city life."

EXPERIMENTS by Grassi, Cattani, Tizzoni, Simmonds, and Sawchenk, made under various conditions and in great diversity of forms, are confirmatory of one another, and afford cumulative evidence of the competency of flies to convey cholera germs. Sawchenk even suggests that the bacilli may be able, under suitable conditions, to multiply within the bodies of flies; in which case, besides being dangerous carriers of infection, the flies would be a veritable hotbed for the preservation and further multiplication of cholera bacilli.

A REMARKABLE illustration of the perseverance shown by roots in seeking food is related in Nature by the Rev. W. H. Oxley, vicar of Peterham. The roots of a wistaria entered the dining-room of Eden House, Ham, by a very small chink in the side of the window near the ceiling. On removing from the walls the paper, which had not been disturbed for many years, the whole of the plaster beneath was found covered with a fine network of roots spreading all round the room. There was no appearance on the paper to give rise to any suggestion of the presence of roots being there. Prof. Dyer remarks that the roots seemed to have behaved more like the mycelium of a fungus than an ordinary axial structure. The room was constantly inhabited, with fires.

THE Italian Minister of Public Instruction, Signor Martini, has called the attention of the Chamber of Deputies to the evils of overpressure in the public schools, under which the programmes have been enlarged without corresponding enlargement of the cerebral convolutions, and the pupils are "swallowing much and digesting little." "While the able-bodied artisan," he says, "demands the restriction of his labor to eight hours, we exact from our boys of ten a labor at once more prolonged and more severe." The minister has been quick to learn from the lessons given him, and has already instituted reformatory measures. The tasks to be undertaken after school hours have been minimized, inducements to prolong mental labor beyond the just limits have been diminished, and the overstrain due to excessive competition is discouraged; the number of subjects to be taken up at once is curtailed, the schools have developed a "modern side," and happy results and improvement are already visible.

IN a recent "long-distance walk" between Berlin and Vienna—some three hundred and sixty miles—the winner among fifteen com-

petitors accomplished the distance in one hundred and fifty-four hours and forty-five minutes, and the one next behind him in a little more than one hundred and fifty-six hours. The winner, however, came in exhausted, while his competitor seemed not to have suffered at all. Both lost five pounds in weight. The remarkable fact about the feat is that these two foremost men are called vegetarians, and were able to walk an average of eighteen hours a day for seven consecutive days on the kind of diet classed under that designation.

FOUR sulphurets are named by M. Jacksh, of Triesch, Moravia, as becoming phosphorescent after a brief exposure to daylight—viz., the sulphurets of calcium, strontium, barium, and zinc. The last compound has been obtained in a luminous condition only recently by distillation in a vacuum. Prepared in the usual way, by precipitating soluble salts of zinc with sulphurets, it shows no signs of phosphorescence. Sulphuret of barium gives a yellowish-orange glow, but only for a few minutes after each exposure to the light, and is of as little use as the sulphurets of strontium and of zinc, the greenish glow of which disappears after about two hours. For practical uses the sulphuret of calcium of commerce is the only phosphorescent of value. Pure, it gives a faint yellowish light; but treated at a red heat, with the addition of a small quantity of a salt of bismuth, it is transformed into a substance giving a violet light and retaining its luminous quality for nearly forty hours after an exposure of only a few seconds.

RECORDS kept by Dr. Spengler at Davos Platz for two years and a half, resting largely on communications kept up with the patients after leaving, show that a permanent cure (of consumptive diseases) is apparently effected in 42·8 per cent of the cases. It is noted that most of the patients were subject to influenza in the epidemic of 1889–'90. In the treatment, till acclimatization is completed and the patient has slept well one or two weeks, he lies much in the open air, and takes little exercise. Patients who come with fever soon lose it.

ALCOHOL, although the most convenient heretofore found, has proved an unreliable fluid for low-temperature thermometers. It is subject to the three vices of sticking in the tube, irregular expansion, and defect from impurities and variations in water content, which affect its expansion materially, M. Chappuis has found toluol, the boiling point of which is 110° C., a liquid well adapted to the purpose and free from these disadvantages.

THE Psychological Section of the Medico-legal Society is interested in all that pertains to psychology, and purposes, through committees appointed from among its members, to make special studies in the departments of animal magnetism, hypnotism, telepathy, clairvoyance, supposed apparitions, and other claims of "respectable" modern spiritualism. It is intended to conduct these inquiries and investigations with candor and fairness, upon strictly scientific lines, and to reach, in so far as possible, a valuable and enlightening collection of facts incident to these phenomena, from which important deductions may be made.

EXPERIMENTS, pursued during two years by himself and his associates, are recorded by Prof. Chodat, of Geneva, concerning the influence of static electricity on vegetation. Beans, sorted into two equal lots, were similarly planted in a vessel filled with sawdust moistened with the same quantity of water, and exposed to identical conditions of warmth and light. One of the vessels was put under electrical influence during a part of the day, rising from forty minutes at the beginning to three and four hours. Leaves began to appear in the electrified lot on the fourth day, while the other lot as yet showed no signs of them. The difference was plainer on the fifth day, and still more so on the seventh, when the electrified plants had grown to a considerable size, while the non-electrified ones were only just starting. The difference was also apparent in the superior vigor of the stems and roots of the electrified plants. The experiment confirmed the opinion that electricity acts to promote germination and growth in length; but the leaves of the non-electrified plants obtained a better development than the others.

OBITUARY NOTES.

THE Rev. T. Wolle, pastor of the Moravian church, Bethlehem, Pa., whose death was recently announced, was an ardent student of fresh-water algæ, and author of three important publications on the Fresh-water Algæ, the Desmids, and the Diatoms of the United States.

CAVALIERE GIUSEPPE ANTONIO PASQUALE, Professor of Botany at the University of Naples, and Director of the Botanic Garden, who has recently died, was the author of several books, chiefly those on the flora of Vesuvius and the flora of Capri.

THE death is announced of Dr. Karl Semper, author of the book in the International Scientific Series on the Natural Conditions of Existence as they affect Animal Life. He was born at Altona, in 1832; studied at Würzburg, chiefly in zoölogy; made a scientific journey in 1859–'62 through the Philippine and Pelew Islands, the results of which were published in several valuable works; became Professor of Zoölogy at Würzburg in 1868, and a few years later Director of the Zoölogical Institute there.